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THE

THEORY AND PRACTICE

OF

LETTERING

DESIGNED FOR THE USE OF

ENGINEERS AND DRAFTSMEN GENERALLY

BUT ESPECIALLY FOR THE USE OF

STUDENTS IN ENGINEERING

BY

CHRISTOPHER E. SHERMAN, C. E.

SECOND THOUSAND
REVISED AND ENLARGED

COLUMBUS, OHIO.
1897.

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PREFACE TO SECOND EDITION.

In the present edition Freehand Lettering has received more attention and is made the subject of a separate chapter, which is in better accord with its importance. Three new whole page plates and eleven cuts are added. Also a few minor changes have been made in the text in various parts of the book.

It gives me pleasure, in this edition, to acknowledge my indebtedness to Professor J. N. Bradford, of Ohio State University, for valuable suggestions offered in both the present and past editions.

C. E. S., COLUMBUS, O., Nov. 6, 1897.

PREFACE TO FIRST EDITION.

The endeavor has been made in the present treatise: (1) To compile and place in order what has been written by others on Lettering, and at the same time to give the writer's own ideas upon the subject, treating those parts which had not previously been touched upon; (2) To reduce the art of lettering, as nearly as its nature permits, to a science; (3) To furnish an elementary practical treatise on the subject for students in engineering.

With these objects in view, the writer has availed himself of all the books he could find treating on the subject, and even had it been thoroughly covered in these books taken collectively a work of compilation, merely, would have been of value, as the literature on lettering is so scattered; but besides being scattered, it is so scant and incomplete that the writer may claim almost entire originality for the present work, and in furnishing a complete treatise on Lettering he believes he will supply an urgent need. For a list of books examined in writing the present treatise see the latter pages of this work.

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GENERAL PRINCIPLES.

Introductory Remarks—Among the features that give effect to a drawing not one is more prominent than the lettering. A map may be well drawn in every other respect, and yet have its looks ruined by poor letters. On this account quite a number of books and pamphlets on lettering have been published which contain some valuable suggestions in the way of illustrations and plates of letters; yet, as a rule, these works furnish but few practical suggestions on the method of putting letters together to form words, and they furnish but few hints as to when to letter, how to letter, and what styles to use on the various kinds of drawings.

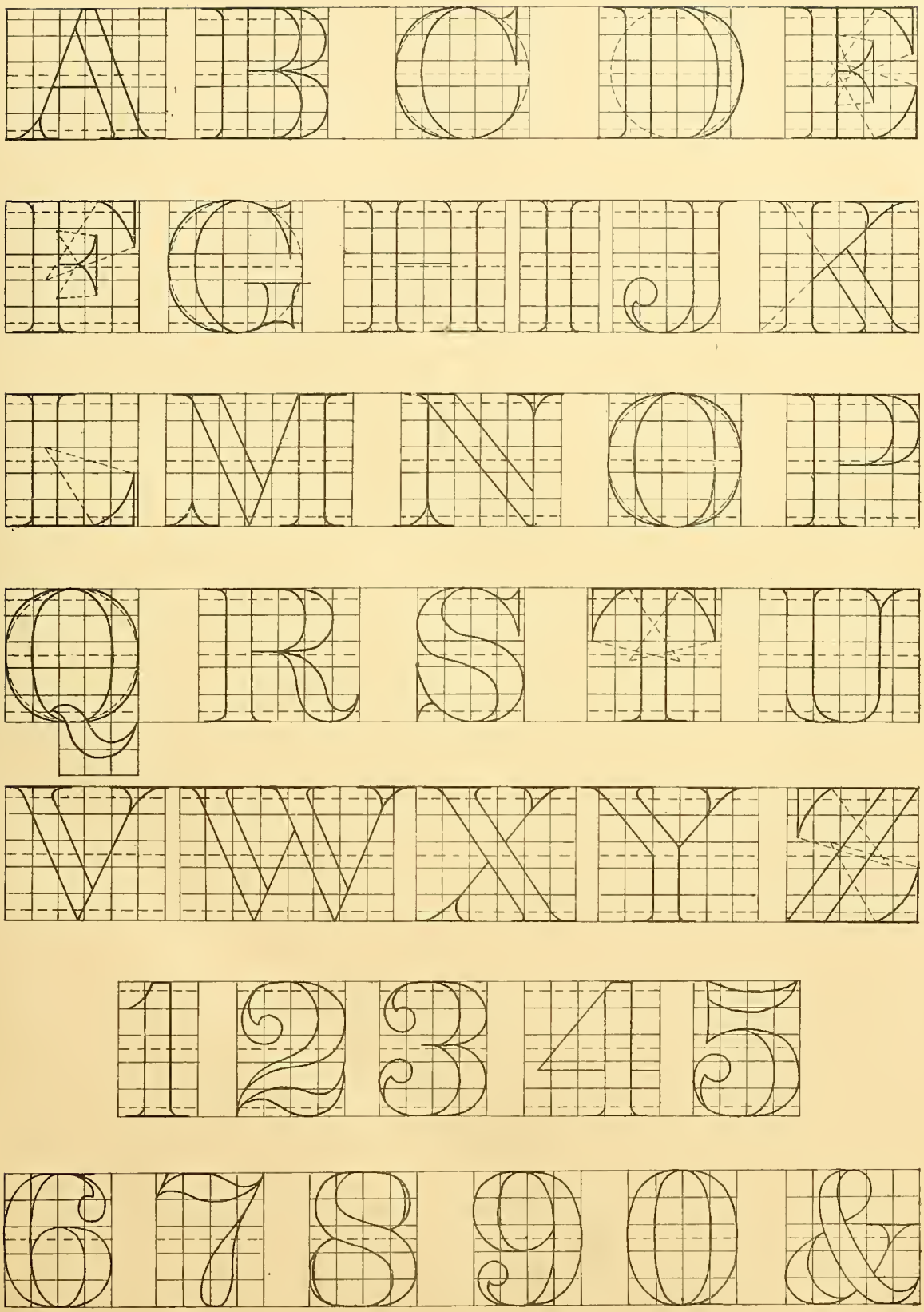
The art of making neat and tasteful letters, such as the ordinary drafting operations of the civil engineer call for, is within the reach of any person who will take the pains to observe the details of good models closely and have the patience to practice lettering until he has mastered those more important details. Ornamental letters and titles, such as are made on maps intended for popular display, or which form the title pages to collections of drawings, may require some high order of talent; but these cases do not often concern the engineer, because in all drawings made for official or professional use, which will include by far the larger part of his work in drafting, the letters, even to the title, should be simple, neat, and dignified in appearance, and should be in accord with the general effect of the rest of the drawing. Every engineer should be able to represent accurately and neatly on paper any operations he may perform in the field or any plans he may design in the office. Such operations will require plats of towns, of city subdivisions and additions, maps of townships, of counties, of railway locations, topographical maps, profiles, plans for structures, and the like; and on all these drawings simple letters, when well made, look best.

Forms of Letters.—The first thing the student of lettering has to master is the forms of the individual letters. Plates I and II present the styles of capitals which the engineer will have most use for, and they give in detail the form of and the relative space occupied by each letter. The Roman and Gothic capitals given in these plates may be easily shaded up in a great variety of ways, so that when the beginner has mastered these two styles, together with the "Single Stroke Gothic" and the stump letters given in plate IV, he is quite well equipped for lettering engineering drawings. There is no short cut in learning the forms of the various letters; it requires careful attention to and patient practice from good models.

Plate I presents the upright Roman capital letters and figures. This style of letter has long been standard, and it is the fundamental form from which almost all others have been derived. It is used to a very great extent in

various kinds of work, and when well drawn is not surpassed in neatness and beauty of form; it therefore demands careful study. The form of each letter can be better understood from a careful examination of the plate than from any perusal of a written description. However, attention should be called to some of the more important points. The space occupied by each letter, it will be seen, has been divided into squares, each square having its side equal in length to one-fifth the height of the letter. The beginner should copy these letters, marking off the requisite number of squares and sketching in the letters as shown. Each letter is made up of thick parts which have not been inked in solidly in this plate in order to show the construction plainly, and of thin lines which in ordinary sized letters, as those given first on plate IV, appear as hair lines. The rule of making the thickness of the heavy parts of the letters equal to one-fifth their height represents average practice. The matter is governed to some extent by the size of the letter. In the United States Coast Survey office the following rule is used: For all publication scales of $\frac{1}{80,000}$, $\frac{1}{60,000}$, and $\frac{1}{50,000}$ the thickness of the heavy parts shall be one-sixth the height of the letter. A good rule perhaps, then, is to make the heavy parts not wider than one-fifth nor less in width than one-sixth the height of the letter. In the present treatise we have adopted a thickness of one-fifth the height of the letter for the heavy parts.

The upper parts of the letters B E S X and Z, it will be seen, are not so large as the lower parts. This fact, which has long been recognized in printing, depends upon a curious property of the eye which was known to the ancients. Take either the large or small letter s for example; if you turn a book upside down and look at the letters, every s will seem much smaller at the bottom than at the top, although when the book is properly held, both parts appear the same size to the eye. This fault of the eye is corrected in the type by making the upper parts of those letters which cause optical illusion smaller than the lower parts. For the same reason the upper parts of the figures 3 and 8 are usually made smaller than the lower. The horizontal hair line near the middle of the letters B E F H and R, it will be noticed, is nearer to the top than to the bottom of the letter, while in the letters A and P it is nearer the bottom. The curved parts of the letters C D G O and Q are arcs of ellipses, as shown by the circles dotted on each of the letters mentioned. Since the curved parts of these letters are so nearly arcs of circles, some draftsmen draw them with the compass, as they do also the curved parts of the same letters when drawn in Gothic style: if the letters are small the difference will hardly be perceptible, but it should be remembered that in standard letters these parts should be arcs of ellipses. The curved parts of the letters E F L T and Z may be made with the compass, if so desired. The center and length of arc are indicated in the plate by the broken construction lines on each of the letters mentioned. The letter L is made the same width at the bottom as the letters E and F are at the top. Two-fifths of a space up from the bottom and down from the top of each letter are drawn broken horizontal lines. These


ABCDE
FGHIJK
LMNOP
QRSTU
VWXYZ
1234567
890&

lines show where to begin to round off the angles at the extremities of the letters. The matter of rounding off these corners, as shown, and of extending the little spurs to their proper length should be carefully observed by the draftsman, as they not only heighten the beauty of the letters, but they also give an impression of accuracy in the drawing. As a general rule, beginners make these spurs too short.

In the foregoing remarks some of the peculiarities of the Roman letters have been pointed out. The student will note others by observing the plate carefully, and will perfect himself by practicing on each letter. In making Roman capitals when no alphabet is near for reference the beginner sometimes forgets which side of the letter to shade (make heavy). In such a case the following rule is well to remember. All parts slanting from the upper left hand corner to the lower right are shaded, and all other inclined parts, with the exception of the letter Z, are not.

Plate II presents the upright Gothic capital letters and figures. In this plate, as in Plate I, the space occupied by each letter has been divided into squares, each square having its side equal to one-fifth the height of the letter. In this plate also, the letters have been inked in only in outline in order to better show their form and construction. A complete Gothic alphabet inked in solidly is shown in plate IV. It will be seen that the main difference between Roman and Gothic letters is that the latter are of the same thickness in all their parts. The same rule which has been given for the shaded portions of the Roman letters, gages the thickness of Gothic letters, that is, the thickness should not be greater than one-fifth nor less than one-sixth the height of the letter. Some of the remarks on the details of the Roman capitals apply also to the Gothic. Thus it will be seen that the letters B E S X and Z, and the figures 3 and 8 are not so large at the top as at the bottom. Also the curved parts of the letters C D G O and Q are arcs of ellipses, as shown by the circles dotted on them; in some styles of Gothic type the curved parts of these letters are made circular, but it is better form to make them arcs of ellipses as shown.

The student can master the Gothic alphabet, given in Plate II, in the same way he has learned to make the Roman letters. Gothic letters being of the same thickness throughout and not having the little spurs nor so many curved parts as the Roman letters, are much more easily and quickly made, and for this reason are much used by the engineer. Gothic letters can be made 'open,' that is, have just their outlines inked in, as in the plate we are now considering, or the outline may be filled in solidly, as in ordinary type, or be shaded up in a variety of ways as shown in plate III, so that it is a style of letter which may be used to advantage on a variety of drawings. An especially useful letter is the Gothic alphabet shaded as shown in the second line of letters from the bottom in plate IV. To make this style, the letters are first sketched in pencil, then those sides of each letter are inked, which would be in shade if the light were considered as coming from the upper left hand corner

down at an angle of forty-five degrees across the letter; if desired the light may be considered as coming from the upper right-hand corner down towards the lower left, and the letters shaded accordingly. Letters formed in this way can be easily made to look neat and can be quickly drawn, two great advantages.

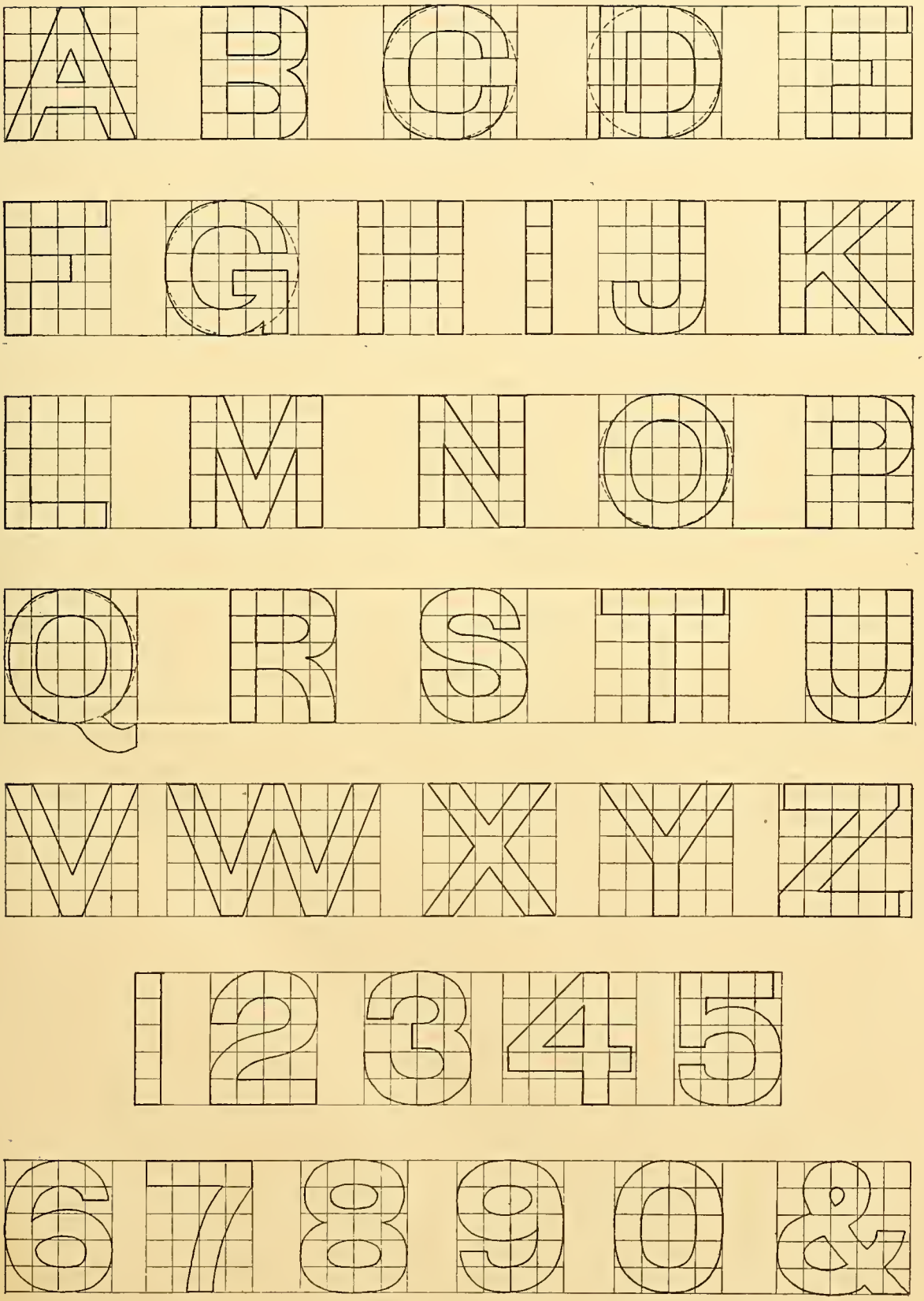
Mechanical Methods of Lettering. — By the method of laying off squares, as illustrated in plates I and II, having regard also to the succeeding articles on spacing, sizing and disposition of the letters, the beginner will be able to letter any drawing he may choose. In this way any desired letters may be sketched on the drawing in pencil and then inked in with the right-line pen, using irregular curves for the curved parts of the letters; the pencil construction lines are, of course, erased after inking.

A second method is to procure from some type foundry a catalogue having a large assortment of letters, and by means of a tracing transfer from the catalogue any desired letters to the drawing. Another way still is to procure stencils of letters of desired sizes and styles from some dealer and use them with the aid of the suggestions on spacing, sizing, etc., already mentioned; but the objection to this method, as is the objection also to the preceding one, is that it requires such a large number of letter stamps or copies, to fit the various cases of lettering that occur, that time is lost in selecting the proper letters from so many. Other mechanical methods, still, may be devised by the ingenious draftsman, but they will be found to be objectionable in some such way as those already mentioned or to have limited uses only.

To save the time which good pen lettering requires, an instrument has been devised by J. A. Ockerson, C. E. The device is described as follows: For letters a stamp is used. The type composing any desired name is set up and clamped in a type holder at the base of the piston, and after inking, is impressed upon the paper through an opening in the base of the frame. The outer edges of this base being rectangular with two of them parallel to the line of type, serve as guides in locating names. For numbers three concentric revolving discs are used, each disc containing the ten numerals in type, so that any combination of three figures is readily formed.

Ockerson's device is being used to some extent by the United States engineers, and it is claimed to be quite economical and efficient in offices where lettering is done on an extensive scale. On smaller works the device has not as yet come into general use, and it is probable that it would not be so economical in smaller offices. The device is sold by the A. S. Aloe Company, St. Louis, Mo., and any one wishing a fuller description can procure a descriptive pamphlet from them. This device and others have been employed to letter drawings, but none of them take the place of the ability to letter drawings freehand as explained later. See chapter on Freehand Lettering.

The Spacing of Letters.—The spacing of letters is fully as important as their correct formation. Each letter may be perfectly shaped, and yet if the letters are not properly spaced the finished word will look awkward. It


A B C D E
F G H I J K
L M N O P
Q R S T U
V W X Y Z
1 2 3 4 5
6 7 8 9 0 &

will be seen from plates I and II that letters vary considerably in their width, the I being the narrowest and the W the widest; "If, therefore, the letters composing a word be spaced off at equal distances from centre to centre, the interval or space between the letters will be more in some cases than in others. Thus in the word

RAILWAY

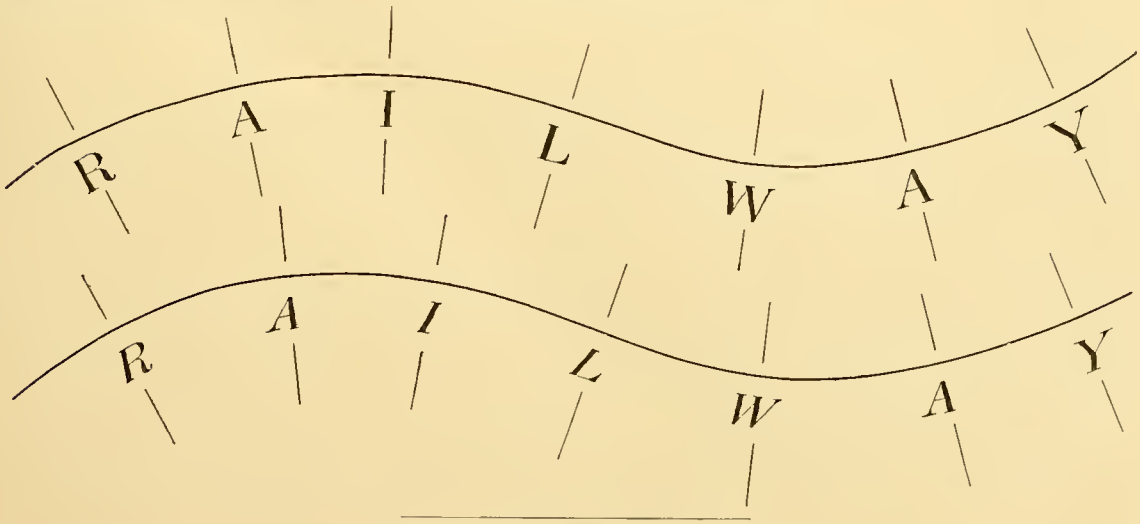
To avoid this write in first one letter and then space off a proper interval and then write in the next letter and space off the interval as before, and so on thus:

RAILWAY

When, as frequently happens, the words are very much extended in order to embrace and explain a large extent of surface or boundary, and the space occupied by the letter is small in comparison with the interval, the disparity of intervals will not be noticed, and the letters may then be laid off at equal spaces from center to center, thus:

R A I L W A Y

When the lines of letters are curved, the same rules for spacing are to be observed as above. If the letters are upright the sides of each letter are to be parallel to the radius drawn to the center of the letter, and the bottom and top lines at right angles to it. If the letters be inclined, as Italic letters, then the side lines of the letters must be inclined to the central radial line, as on a horizontal line they are inclined to the perpendicular, thus:*

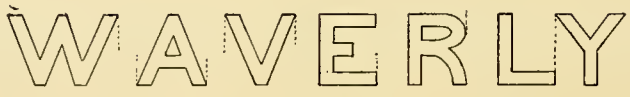


*Appleton's Cyclopedia of Drawing.

However, upon closer examination, we find that the method of spacing first explained above does not completely remedy the difficulty. For plainer illustration, let us take the word "Waverly." From plate II we can find the proper width for each letter, and we will accordingly write in the letters, allowing between each one an interval equal to two-fifths the height of the letter (the usual interval), thus:

It will be seen that notwithstanding the fact that we have not spaced the letters off at equal distances from center to center, but have given each letter its proper width with the same interval between each one, the word, as a whole, looks awkward to the eye. The fault is that the letters L and Y appear to be quite too far apart, and the letters W A and V slightly too much so, to agree with the spacing of the other letters.

This defect can be remedied by making the intervals between the letters mentioned smaller than those between the other letters, thus making the intervals irregular as well as the widths of letters, as follows:



Here it will be seen that while V E R and L are a full interval apart, the distance between the space marked off for W A and V is less than a full interval, while there is little or no interval between the spaces marked off for L and Y. Upon the same principle we might have made the interval between the spaces marked off for V and E slightly less than a full interval. Thus we may gather the following: when the letters L and T, L and Y, T and A, L and V, T and J, F and J, etc., come together in the order indicated, they should be spaced considerably closer together, and when letters occur in words thus, VA, AV, VO, FO, TO, WA, or similar combinations, they should be spaced slightly closer together in order that the finished word will not appear to be irregularly lettered but will look correct to the eye. There should not be a preponderance of black nor of white and to gain this end the white areas between the letters should be approximately equal in amount. The idea in spacing letters properly, thus, is the same as in making map work neat generally, the letters should be so spaced as to impart the desired impression clearly and quickly and give a pleasing general effect. The interval between words ordinarily is equal in width to the height of the letters on the line. But this matter depends so much on circumstances that there is no regular rule to be followed.

The details which have been pointed out above may seem trivial, but it is exactly attention to these little matters that makes the skillful draftsman, and

if they are carefully studied and practiced at first it will afterwards become second nature for him to observe them.

Size of Letters.—The size of the letters relative to the drawing on which they are to appear is an important point and will depend upon two things; the scale of the drawing, and the importance of the object described. The largest letters are generally used in the title for the name of the object or tract represented, the smallest for explanatory notes usually; and between these dimensions, the sizes are proportioned to the importance of the different features represented. Numerous suggestions have been offered in defining the heights of the letters to be used, but it is hard to frame a rule that shall fit the great variety of drawings that have to be lettered. The following proportions have been suggested by Professor McMillan, C. E.:

Scale.	Height of largest upright capitals.	Height of small letters for explanatory notes.
$\frac{1}{600}$ or 1 inch = 50 feet.	$\frac{6}{10}$ inch.	$\frac{12}{100}$ inch.
$\frac{1}{2640}$ or 2 feet = 1 mile.	$\frac{5}{10}$ inch.	$\frac{10}{100}$ inch.
$\frac{1}{5280}$ or 1 foot = 1 mile.	$\frac{4}{10}$ inch.	$\frac{8}{107}$ inch.
$\frac{1}{10560}$ or 6 inches = 1 mile.	$\frac{3}{10}$ inch.	$\frac{6}{100}$ inch.

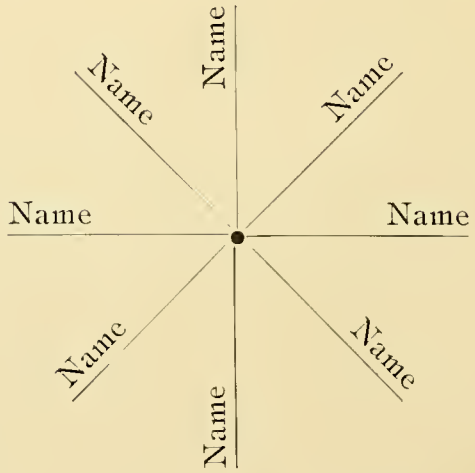
But since a pond in one map may rank in importance with an ocean in another, it is evidently impossible to prescribe exact sizes of letters for the different features. The following has been suggested by another writer: "As a rule no letter should exceed in height $\frac{3}{100}$ of the length of the shorter border of the drawing on which it appears." This may be followed as a general guide in limiting the size of the largest letters to be used, while the propriety of relative importance should, of course, be everywhere observed, as for example, on a map a city demands larger letters than a town, a river needs larger letters than a creek, and a county would require larger letters than a township. The above rule, together with an examination of the drawing in hand and observation of other drawings, will serve to give the beginner a fair idea of the proper gradation. It is the rule for beginners to make the letters too large for the drawing, and they seldom get the lettering proportionately too small.

Disposition of the Letters.—Names should be so placed on drawings as to be easily read, show clearly the object designated, and not obscure the other features of the drawing. After the careful consideration of this rule the draftsman should next bear in mind that names should be so placed as not to appear crowded and thus mar the general effect. The following rules taken from Reed's "Topographical Drawing and Sketching" are well chosen, and apply to drawings in general as well as to maps in particular.

For isolated features, the names are placed, when possible, at the right or left of, and close to the different objects designated and parallel to the lower edge of the border, the space between the letters and words conforming to those of ordinary print.

For communications, the names are placed parallel and close to the edges or boundaries ; the spaces between letters remaining the same as in ordinary print, while the words are separated by intervals, which for information in the same map, may be taken equal to the length of the largest word there used for these designations. The bases of the letters are best turned toward the communication, and such part of the latter should be selected for the name that when the drawing is held in its proper position the letters will not be reversed: e. g. if the road extends upward to the right or downward to the left, or in a vertical direction, the name is placed on the left of it ; if horizontally, above ; otherwise to the right.

For streams the same rules apply as for communications, except when their widths are at least twice the height of the letters, in which case the names are placed along the axis of the streams, independently of the direction of the current which is indicated by an arrow. The accompanying figure shows the proper position of names relative to lines of features having various directions.



For elongated outlines, as in the case of forests, marshes and bodies of water, the names are extended in the direction of greatest dimension and along straight or smoothly curved lines midway between the boundaries. The letters are not " extended," but with the words are so spaced that the name in each case will occupy nearly the entire length of the feature, the spaces being proportional to those used in ordinary print. In certain cases, when names placed on the features would obscure them, or the scale of the map is very small, a legend, or list of the names is placed in an unimportant part of the map, or outside the border ; and corresponding letters or numerals attached to the different names and features serve as mutual references. These names should be horizontal, and arranged in one or vertical rows.

When to Letter.—The entire drawing, even to the lettering, should first be made in pencil if the draftsman would be sure of his work. Disregard of this rule many times spoils a drawing and often wastes time in the end. Generally in a pen drawing, with the exception of the title, the letters should be inked in first, as the characteristic lines of the other features will usually be more easily followed if they should be broken, than would the lines of the letters. Of course it is preferable to so place the letters that, observing the rules already given for disposition, they will not fall on places which other features must occupy ; but this is often unavoidable and in such a case the feature that is most easily followed is the one that will be broken, if one must be broken. The features of a drawing are sometimes inked in over the letters and where this must be done and the letters are large they should be made 'open'; but where no mistake will be made if the feature be broken enough to make room for each letter, it is best to do this.

If the drawing is to be tinted the letters should be inked in last, having been so executed previously in pencil that no erasing will be required after inking; the tint would be partially removed by erasing the pencil lines that have been washed over, and besides there is no ink which will not blur to some extent upon being washed over, however much advertised to the contrary.

Style of Letter to be Used.—The style of letters to be used depends upon the particular kind of drawing on which they are to be placed and upon the permanent general interest of the drawing, and generally more than one style is used to designate the different features of the same drawing. Usually it will be found advantageous to use several styles to describe the various features, but it is not advisable to use too many styles on the same drawing where many of the different features can be distinguished easily by differently sized letters of the same style. We should follow this rule; the letters used should agree with the character of the drawing, that is, they should be in accord with the general effect of the drawing on which they are placed. Thus while a complicated and highly finished drawing may receive letters of a more ornamental character, plain and simple letters look best on a plain drawing. We would not use Rustic or vaguely formed letters on a geometrical drawing ; on such a drawing one of the geometrical styles, say the Block letters, or the Geometrical letters, or some such modification as the alphabet between the words "Finished Roman" and "Extended," shown in plate III, would be more appropriate.

For topographical maps and for maps of large tracts, say maps representing areas of one hundred square miles and upwards, Roman letters are in best taste, as on such drawings these letters are standard. All water features occurring on such drawings where Roman letters are used, should be designated by inclined Roman letters, and water features generally on all drawings should be designated by inclined letters. The reason for this is, inclined letters are more easily read, and produce a more pleasing effect when names are placed obliquely to map borders, as often happens for water features.

For city plats, plats of subdivisions and additions, Gothic letters plain or with various shadings may be used, as these are rapidly made, and look well on this class of drawings. For plans of structures and the like the same Gothic letters may be employed, and as the drawing becomes more elaborate this style may be replaced by more elaborate letters if the character of the drawing requires it. To designate minor features, as for example unimportant localities on large maps, bills of timber on plans, and the like, the stump letters given in plate IV are largely used in all drawings. Inclined Roman capitals should be used with these stump letters, and the latter are made three-fifths as high and three-fifths as thick as the capital letters which go with them.

For drawings in color, as for example tinted topographical maps, "light faced" or 'open' letters such as are shown in plates I and II, the second line of letters from the top of plate IV, and the "Finished Roman" letters given in plate III, give a more pleasing effect. Script or stump writing is well adapted to field sketches. No writing should be allowed on a finished drawing, as it may be quickly marred by designating features in hand writing.

Owing to the haste with which drawings sometimes have to be made and the time consumed in making ordinary letters, a style of lettering called Round Writing, also called German Round Hand, has for some time been in use. An example of this style is given in plate III; it has of late been used to quite an extent by engineers, especially on working drawings. The objection to it is in kind similar to that urged against hand writing, that is, it does not so easily give a clear and concise impression as the older and standard styles of letters; it can not always be read at a glance. This objection is not nearly so marked, of course, in Round Writing as in hand writing. However, as lettering by this means is so rapidly done, Round Writing will probably always be used to quite an extent, especially in working drawings. The method was devised by Frederick Soennecken, and was used in Germany before being introduced in this country. The characters are all made by single strokes of the pen, an especial pen and pen-holder having been devised by the inventor for the purpose. The student who wishes to inquire further into the subject can procure copy book, pens and holder from Keuffel and Esser, New York and Chicago. The copy book contains instructions for learning the method.

In plate III a number of styles are given, various uses of which will suggest themselves to the draftsman. The Pearl, Old English and Velvet, are examples of styles which have been much used, but which are now used on drawings intended for public display only, or which are to be kept as permanent records, and on which, therefore, more time may be spent on the lettering; they are too elaborate and hard to make, and should be used only on such drawings or in title lettering, where a few, perhaps, may be used for variety. The Old English alphabet, when well made, looks very neat on many less technical kinds of work, but it is quite hard to execute. The letters J and I in this alphabet are made alike.

The effect of various shading is illustrated in the Gothic letters at the

GOTHIC LETTERS SHADED

UNITED VARIOUSLY STATES

FINISHED ROMAN

PRACTICE MAKES PERFECT

ABCDEFGHIJKLMNOPQRSTUVWXYZ

EXTENDED

A Word To The Wise Is Sufficient

ALPHABETS

ABCDEFGHIJKLM

PEARL

Round ITALIAN PRINT Writing

3 ABCDEFGHIKLMN 3

OLD ENGLISH

A OPQRSTUWXYZ N

BDFHJKNPQ GEOMETRICAL SUVWXYZ&

GEOMETRIC ITALIC VELVET INCLINED GOTHIC

NOPQRSTUVWXYZ

LITERARY QUAINT ROMAN MEDAL, PROGRESS

QUAINT OPEN NUGGETS MELANGE

HELPFUL HINTS OUR MEDICAL MUSE

THE FACTOTUM CLINICAL CLIPPINGS

EMPIR SHADED ROMAN UNDRY

FGJM VARIOUSLY NPQW

XSHADED BLOCK LETTERSZ

top and the Roman and Block letters at the bottom of the plate. 'Finished Roman' letters may be shaded up in as many different ways. Roman letters shaded as the letters E M P I and R, near the bottom of the plate, make very good letters for important title words. In the various words near the bottom of the plate below the Velvet letters N to Z, and above the words "Shaded Roman," is illustrated the effect of different shading together with modified forms. These words, selected from advertisements, etc., also illustrate the value of correct spacing. Take the word "Melange" for example; the individual letters are oddly shaped, yet the spacing is true, and the word, as a whole, is not displeasing to the eye. According to what has been previously said, these letters would hardly be used on strictly technical drawings, but they are given here for purposes of illustration. Attention is also called to a few other points. The words "Extended" and "Alphabets" show how the proportions of letters are varied occasionally in order to make the word fill a space of certain shape. The two forms of the figure 3 given, are used by some draftsmen, and are allowable, although not standard forms. The letters A and N, on either side of the old English letters O to Z, are examples of how letters, as well as figures, are modified in form to suit the draftsman's fancy. The inclined Roman capitals, with some of the letters modified as suggested, are used to some extent with stump letters, The student may, if he wishes, practice in these more elaborate letters, finish the alphabets which are given in part or suggested in the plate.

We have given above some few practical suggestions to the beginner on selecting suitable styles for various drawings. The matter of selecting appropriate styles is, however, more a matter of observation and experience than a question to be settled by rigid rules. If the student wishes, he may become acquainted with more elaborate styles by observing street signs, advertising lithographs, and the like, or by referring to some of the alphabets which have been published for the use of sign painters, engravers, jewelers, artists and draftsmen. Of these, the book of alphabets by Copley is most suitable for the engineer. But these elaborate letters, while well suited for the purpose of attracting popular attention, as in advertising, or of gratifying the aesthetic taste in artistic work, are ill adapted, usually, to the needs of the engineer, and it is better for him to master thoroughly a few simple styles than to be an indifferent master of the many more elaborate alphabets.

FREEHAND LETTERING.

After the student has become familiar with the forms of each letter, and has learned to letter by dividing up the space for each one into squares and using the drawing pen and irregular curves as explained in preceding articles, he should then learn to make the letters freehand, simply using two pencil lines for guides. While the mechanical methods previously explained may be resorted to in making large letters on elaborate maps or on drawings which are to be kept as permanent records, and on which the draftsman will have time to make the letters exact, yet in most drawings this is too slow a method, and he should be able to make letters freehand neatly and quickly.

Accordingly in plate IV are given the six alphabets which the student should learn to make freehand. The upright and inclined Roman small and the Gothic small alphabets, given in the plate, have been put in more for completeness than for any great use which is made of them by the engineer; they need not be mastered as they are so little used in drafting. The upright and inclined Roman small letters are used in the published maps of the U. S. Coast and Geodetic Survey, and the U. S. Geological Survey, but outside of this they and the Gothic small letters are not much used in engineering drawings for the reason that it takes so much time to make them, and then they often do not look neat. Stump letters are employed almost universally in drafting in place of the upright or inclined Roman small letters. These stump letters should slant at the same slope taken for the Roman inclined capitals and inclined small letters (and for other inclined, italic, letters generally), that is, a slope of three to eight.

The upright and inclined Roman capitals, the single stroke Gothic, the stump letters, and the upright and inclined Gothic capitals, which are given in plate IV, are used almost daily by the draftsman, and when the student has learned to make these letters freehand neatly and quickly he is well equipped for lettering engineering drawings. In making these freehand letters two pencil lines should always be ruled for guides one at the top and one at the bottom of the row of letters, and if desired a third guide line may be drawn midway between the other two, the letters being always sketched in first in pencil. Even though the student may not succeed in thoroughly mastering these styles with regard to the forms of the individual letters, still with the proper spacing and sizing the effect is superior, as has been previously stated, to lettering in which each letter is perfectly formed, but in which the spacing or sizing has been improperly done. So, therefore, let the student master as nearly as he can the freehand styles given and not become discouraged if he does not become expert.

UPRIGHT ROMAN CAPITALS

A B C D E F G H I J K L M N O
P Q R S T U V W X Y Z &
1 2 3 4 5 6 7 8 9 0

INCLINED ROMAN CAPITALS

A B C D E F G H I J K L M N
O P Q R S T U V W X Y Z

UPRIGHT ROMAN SMALL

abcdefghijklmnopqrstuvwxyz

INCLINED ROMAN SMALL

abcdefghijklmnopqrstuvwxyz

SINGLE STROKE GOTHIC

ABCDEFGHIJKLMNOPQRSTUVWXYZ

STUMP LETTERS

abcdefghijklmnopqrstuvwxyz

UPRIGHT GOTHIC SMALL

abcdefghijklmnopqrstuvwxyz

INCLINED GOTHIC CAPITALS

A B C D E F G H I J K L
M N O P Q R S T U V W X Y Z

UPRIGHT GOTHIC CAPITALS

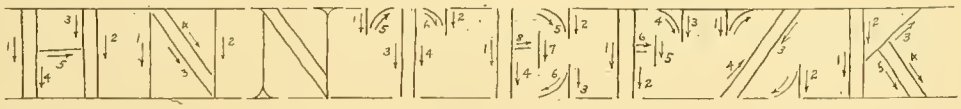
1 2 3 4 5 6 7 8 9 0
A B C D E F G H I J K L M
N O P Q R S T U V W X Y Z &

In making letters freehand the direction and order of making the strokes materially affect the appearance of the letters and the speed with which they are formed. Almost every experienced draftsman has his own method of forming the ordinary styles, yet in the main, the letters should be and are, usually best formed in a given manner, and the writer has given in the instructions and illustrations which follow, methods which it is believed the student will find useful.

The directions given for forming upright Roman and Gothic letters apply chiefly to 'penciling in' the letters. When the letters are inked in, the *order* of making the strokes may be varied, but it will be found best to make the strokes in a direction toward the draftsman, especially if a fine pointed pen is used. This kind of a pen will generally be used for large Roman and Gothic letters, or letters which cannot be made by single strokes.

In the instructions given in the following articles of this chapter, where the thickness of a letter is spoken of, the width of the heavy part of the letter is meant, as for example the distance between strokes 2 and 3 in the letter H of the cut below (or the distance between the same strokes in the Gothic letter H on page 18). Where the width of a letter is mentioned, the distance between the limiting verticals is meant, as for example, the distance between strokes 1 and 2 in the letter H alluded to.

Upright Roman.—Always draw two pencil guide lines. In the Roman and Gothic letters, as a general thing, the outer or bounding lines of a letter should be drawn first. The letters in the following cuts have been grouped approximately in the order of their difficulty of execution.



Passing by the letter I, the letter H is the easiest to draw neatly and quickly. Draw the two outer strokes 1 and 2 at the proper distance apart, this distance being gaged by the distance between guide lines, or in other words, by the height of the letter. (The student before attempting freehand lettering should thoroughly familiarize himself with the forms of the letters as set forth in plates I and II, in which plates are given the widths of the letters as compared with their heights.) Next draw the inner strokes 3 and 4, then add the horizontal stroke 5 slightly above the middle of the letter. Lastly, the spurs are added at the top and bottom, the strokes being taken in the same direction as stroke 5.

The two outer strokes of the letter N are first drawn, giving the letter the proper width as gaged by the distance between the horizantal guide lines, then the diagonal stroke 3 is made, the lower right hand apex of the letter being left blunt as in plate I, or being made acute. In the latter case it will help the appearance of the letter to extend the acute lower apex just a trifle below the lower guide line as shown in the finished N of the cut.

The spurs of the letters are always drawn last, as they can then be more easily and better placed. Care should be taken to extend them a proper length (see plate I). When the letters are inked in, the vertical strokes can be rounded into the horizontal spurs, but the draftsman should guard against making this curve too flat. With this understanding, in most of the letters following the spurs have been omitted in order to simplify instructions.

In the letter T make the two outer strokes first, then draw the central part or stem, afterwards drawing the curved parts, and lastly drawing the upper horizontal line (connecting strokes 1 and 2) and the lower horizontal line or spur at the base of the stem. The two downward projecting parts or wings of the T should be made long enough and full enough to make the letter look pleasing, otherwise the letter will have a 'starved' appearance. The same remark applies also to the similar portions of the letters E F L and Z.

The letter E is outlined in the manner shown. The order of making strokes is not so material after the bounding lines of the letter are drawn, but it should be noted that the letter is slightly narrower at the top than at the bottom, and that the horizontal line is drawn a little above mid-height of the letter. The top and bottom horizontals are drawn last, taking care to extend the spurs to the left of the letter to their proper length.

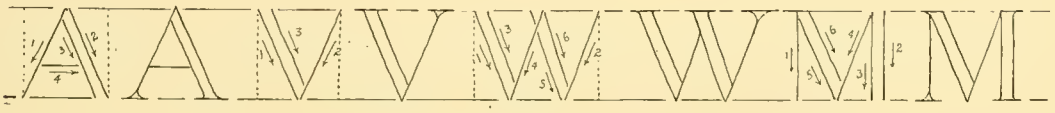
The letter F may be drawn as indicated, stroke 3 being at the same distance from stroke 1, as stroke 2 in the letter E is from stroke 1 in the same letter, and the middle horizontal in F being at the same height as in the letter E. L is drawn much as the letter F is drawn. L is the same width at the bottom as F is at the top.

The limiting strokes 1 and 2 of the Z may be drawn first, or the correct width of the letter may be first spaced off on the lower guide line. Stroke 3 begins on the upper guide line directly above stroke 2, and stroke 4 extends upward (in a pencil stroke) from a point on the lower guide line a little to the left of stroke 1, for it must be remembered that Z is slightly narrower at the top than at the bottom. A little shifting of parts of strokes 3 and 4 may be necessary to secure the proper shape for the penciled letter, as, indeed, in making other letters of the alphabet lines often must be shifted from the first position given them by the inexpert (or even experienced) draftsman.

The vertical part of the letter K is usually drawn first; then stroke 3 begins on stroke 2 at $\frac{2}{5}$ the height of the letter from the bottom, and is drawn upward to the right at such an angle as to make the width of the letter at the top equal to $\frac{4}{5}$ of its height. It is well to place a dot on the upper guide line where stroke 3 ends before drawing the latter. Stroke 4 makes the width at the bottom a little wider than at the top. Then stroke 5 is made, and the finishing touches added.

Time must be taken by the student to secure the proper form for the letters. The novice often fails to realize this. That plain Roman letters look so simple when completed, does not signify that they are readily made except by those who began slowly and have gained rapidity by much practice and experience.

In the letter A the proper width of the letter is marked off by the two vertical lines shown in the cut, this space on the top guide is bisected, and from or near this middle point the strokes 1 and 2 are drawn. Or if the draftsman is expert, strokes 1 and 2 may be made without the vertical guide lines. Then strokes 3 and 4 are made, the spurs and little curved parts at the lower parts of the letter being made last. If the upper part of the letter A is drawn to an acute apex, this latter should extend a trifle above the guide line, for optical reasons mentioned on page 2, and further illustrated in the cut accompanying this article, Figure A on page 17.



It will be noted here that the students ability to estimate by eye directions and distances is severely tested in lettering. For example, drawing the two outer lines of the letter A at the same slant but in opposite directions without the guides above mentioned, is a good exercise in estimating direction. It would be well for the student to practice himself in such simple exercises as the above, and such other exercises as drawing, freehand, perpendiculars to the guide lines; placing dots on the upper guide line directly above dots on the lower guide line; etc., etc., afterwards testing the accuracy of his eye by triangle and T square.

V is constructed in essentially the same manner that A is drawn. The apex of the letter, if made acute, is better extended a trifle below the lower guide line as shown in the finished letter.

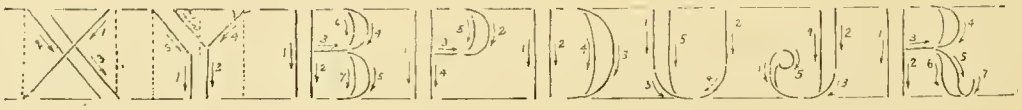
W might be constructed as two V's placed side by side, or it may be drawn as illustrated by the cut, the two outside lines 1 and 2 being drawn first at the proper distance apart and at the correct inclination. If this latter method is followed stroke 3 is next made as shown, then the space on the top guide line between 2 and 3 is bisected and from this bisecting point stroke 4 is drawn parallel to 2. If stroke 4 thus drawn does not form an acute apex with 1, strokes 1 and 2 and 4 must be readjusted. With practice though, and on ordinary sized letters these lines will very seldom require readjustment. Strokes 5 and 6 and the horizontal spurs complete the letter. A width of the letter somewhat narrower than that shown in plate I is recommended, and if the lower apexes are made acute they should, as in the case of the V extend very slightly below the lower guide line. Some draftsmen in making a W omit the part of the stroke 5 lying to the left of stroke 4, thus forming an acute apex on the upper guide line in the middle of the letter. Since in type forms, almost universally, a W is printed as shown in the cut, the letter when drawn as last above mentioned has an unfinished appearance to the eye.

The two outer strokes 1 and 2 of M are first drawn. Then stroke 3 is drawn, making the stem of proper thickness. Then on the lower guide line

bisect the space between strokes 1 and 3, and draw strokes 4 and 5 to intersect at this point. Stroke 6, with the horizontal spurs or "ceriphs" as the type founder calls them, completes the letter.

X and Y are not always easily made. For X it is usually best to mark off the space to be occupied by the letter by two vertical limiting lines (the two dotted lines shown in the cut). Then strokes 1 and 2 are drawn, remembering that X is wider at the bottom than at the top. If the lower part of stroke 3 is drawn before stroke 2 is finished, it will assist in correctly placing the lower part of the latter stroke.

For Y mark off the limiting lines as shown and bisect the space between them on the bottom guide to serve as a guide for strokes 1 and 2. Then draw the stem first by strokes 1 and 2, and draw stroke 3 from the upper left hand corner down to intersect stroke 1 at mid-height of the letter. Stroke 4 is drawn from the upper right hand corner down to intersect stroke 2 slightly above mid-height, and stroke 5 is drawn to or from this intersection parallel to 3. Care should be taken to see that the heavy slanting part of the letter (i. e., the part between strokes 3 and 5) is as thick, or very nearly so, as the vertical part of the letter. If preferred, stroke 5 may be drawn next after 3 and parallel to it at the proper distance until 2 is intersected. From this intersection stroke 4 is drawn to the upper right hand corner.



The letter B may be drawn as indicated, the outside strokes as usual being drawn first, with the exception that strokes 2 and 3 are drawn before 4 and 5 to guide the latter. Stroke 3 should be slightly above the middle of the letter, as shown in plate I. After a little practice strokes 4 and 5 may be drawn next after 1, then drawing strokes 2, 3, etc.

P may be drawn as indicated. The horizontal line, stroke 3, should come slightly below mid-height, instead of slightly above, as in B and R.

The manner of drawing D is shown. Strokes 3 and 4, it must be remembered, in large letters are not circular, but are arcs of ellipses.

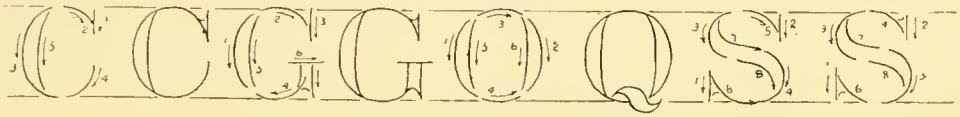
The two vertical outside lines of U should be drawn first, marking off the proper width of the letter. The bottom is next drawn by the two strokes 3 and 4, stroke 5 finishing the main part of the letter. If the letter is small, stroke 1 may include 3, and strokes 2 and 4 may also be made together.

Since lettering is done from left to right, as is writing, the curved stroke 1 in the letter J is drawn first. Strokes 2, 3 and 4 are made in the order given, but in large letters the bottom of the J should be drawn as in U.

The first part of R is practically identical with the same portion of B. Strokes 5, 6 and 7 finish the letter, excepting the ceriphs. Stroke 5 should

leave stroke 3 before the stroke inside of 4 joins the former. Also stroke 7 should be taken in the direction indicated. Such a trifling matter as this often materially affects the appearance of a letter.

The curved parts of the letters C G O and Q are arcs of ellipses. The manner of constructing these letters is essentially the same in all. The writer has been in the habit of forming these letters by making the strokes in the order and directions shown in the letter C. Perhaps a better way is shown in G. The horizontal line in G is drawn at two-fifths the height of the letter. It should be noted that in C and G stroke 2 comes down tangent, or very nearly tangent, to the vertical straight line.



The method of constructing G is shown. Q is constructed as an O, and then is added the distinguishing curved part at the lower part of the letter.

The letter S is usually the hardest letter of the alphabet for the student to make. The two S's shown in the cut show that the order of making the strokes may be varied. They were drawn rapidly freehand, and as the method has been found successful in practice, it is here recommended for trial. In the first S, strokes 1 and 2 mark the limits of the letter, it being remembered that S is slightly narrower at the top than at the bottom. Stroke 3 curves as far to the left as stroke 1, but stroke 4 curves a little farther to the right than stroke 2. Strokes 5 and 6 are made tangent to strokes 2 and 1 respectively, and strokes 7 and 8 are always made last, except the little short curves between strokes 2 and 5, and between 1 and 6, which finish the spurs.

Sometimes the letters C G O and Q are so drawn that the heavy parts do not extend as far around the letters as shown in plate I, in other words do not extend to the guide lines, the inner strokes (as, for example, strokes 5 and 6 in O) being made nearly straight vertical lines. When this is the case these heavy parts should be made slightly thicker than usual, and the height of the letter should also be slightly increased, as, for example, the strokes 3 and 4 in O should curve slightly outside the guide lines, as they do in the letters of the above cut. The reason for this, which has been mentioned before, can be better seen from the following cut:

Fig. A.

HOVZ AMOEV

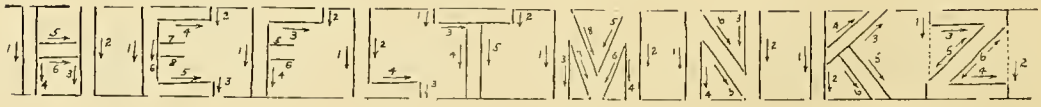
In this figure the letters H, O, V and Z are all drawn the same height and width and thickness. Yet the O appears neither as high, nor as wide, nor as thick as the other letters mentioned. The letter V does not appear to be as wide as H and Z, neither does it appear to be so tall as the latter. (This is

perhaps better shown in the Gothic letters in the same figure. Here the two parts of the V have been made to come down to a sharp apex for clearer illustration of this principle, and it will be plainly seen in this case that V appears to be a trifle shorter than E). Notice, also, that the Z in the figure appears to be a little top heavy. This is because the letter was made the same width at the top as at the bottom. This will partially serve to show the student why letters should be given certain forms.

The Gothic letters in the same cut, **A M O E** and **V,** are all drawn the same width, height, and thickness, but the **O** appears smaller than the other letters. The form of **V** given is not strictly correct, having been modified at the apex to better illustrate a point already spoken of. It will be seen that the same principles apply to Gothic letters as well as to Roman letters.

Upright Gothic—When Gothic letters are too thick to have their various parts made at single strokes, the direction and order of penciling the strokes, as given in the instructions and illustrations following, may be used. Gothic letters of large size are, as a rule, much easier to make than Roman letters of the same size, as the Gothic letters are of the same thickness in all their parts, and have not the little spurs, etc. Small Gothic letters with corners sharply defined, as in Gothic type, are as difficult to make as Roman letters and look as well almost as the latter if correctly drawn (see type specimens). However if a ball-pointed pen is used, a style of small Gothic letters may be made easily and quickly, in which the angles or corners will not always be sharply drawn; nevertheless, this style of letter is very useful, and looks quite neat when properly done, so instructions are given for the style in an article on Single Stroke Gothic.

As in the case of Roman letters, it is generally best to draw the outside lines of Gothic letters first, gaging the width of each letter so marked off by the distance between guide lines, in other words, by the height of the letter. The method of sketching each letter is shown in the following cuts, and but few additional directions will be needed.



The following are some of the points to be noted: The middle horizontal bars in the letters **H E** and **F,** although to be properly placed should be slightly above mid-height, but are often placed just half way between the guide lines, this matter depending on the size and thickness of the letter. In large letters the bar may be placed at mid-height.

Draw the outside lines of the letter **M** first; place two dots on the lower guide line equidistant from strokes 3 and 4, and similar dots on the upper guide line where strokes 3 and 4 would intersect the same. The dots serve as further guides for the slanting strokes, since these latter are drawn from the dots at

such an angle that the distance between them, as say, between strokes 5 and 6 will equal the thickness of the letter. Care must be taken not to get these slanting parts too thick, indeed they might be made very slightly thinner than the vertical parts of the letter. The remarks on the slanting parts of **M** apply also to **N, Z,** and **W.**

K is drawn substantially as in the Roman form. Draw strokes 1 and 2, then at $\frac{2}{5}$ the height of the letter on stroke 2 begin stroke 3, extending it upward to the upper guide at a point previously set, marking off the proper width of the top part of **K.** The other strokes are made in the order shown. The lower part of **K** is wider than the top.

For **Z** draw limiting verticals first. Strokes 1 and 2 mark the thickness of the letter. Next, below stroke 1, and slightly to the left, draw a vertical from the lower guide; above stroke 2 draw a vertical from the upper guide line, both these verticals should be slightly less in length than the thickness of the letter. With the lines mentioned, drawn first, the rest of the letter can be easily drawn.

In penciling in the letters **A V W X** and **Y,** always draw the limiting vertical first, as shown in the cut. **A** and **V** are drawn in substantially the same manner. Bisect the distance between the limiting verticals, place dots on either side the bisecting point at the proper distance apart (i. e. the thickness of the letter) and then with these guides draw the slanting strokes in the order given.

The limiting verticals of the letter **W** can be spaced the proper distance apart by drawing the left vertical, then placing a dot on one of the guides at a distance equal to the height of the letter, then drawing a vertical to the right of the dot at a distance equal to $\frac{3}{5}$ the distance from this dot to the left vertical. The order of the strokes is shown in the cut. Strokes 5 and 7 meet the upper guide line equidistant from 4 and 3 respectively, the guiding dot (o) having been previously placed half way between strokes 3 and 4. Note that the strokes 5 and 6 should be parallel to 2 and 3, and that 7 and 8 should be parallel to 1 and 4. If the letter is properly drawn the axes of the slanting parts will intersect upon or just a trifle within the guide lines.

The manner of sketching **X** is shown. Remember **X** is narrower at the top than at the bottom. It might be better to draw stroke 8 before stroke 7, or at least the upper half of 7, is drawn.

The Gothic letter **Y** is much more easily drawn than the Roman form of the same letter, since strokes 5 and 6 intersect 4 and 3 at the same height, i. e. at about $\frac{3}{5}$ of the height of the letter. Draw the guide lines 1 and 2 and a vertical mid-way between them before beginning on the letter itself.

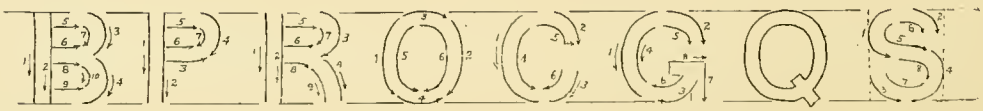
The manner of drawing **D, V,** and **J** is, perhaps, sufficiently illustrated in

the cut. It is not necessary to adhere *rigidly* to the directions and order of strokes given in the cut, but the method there illustrated has given satisfactory results. The curved strokes in the letter **D** are arcs of ellipses in large letters.

B, P, and **R** are explained in the cut. The upper part of the letter **B** is smaller than the lower part. The lower right hand portion of the **R** is sometimes made straight instead of curved, as in the words "Draft Rigging" in the title in plate V.

The curved parts of the letters **C G O** and **Q** are arcs of ellipses as in the Roman style, but some draftsmen draw them circular, and they are thus made in some type forms.

The horizontal and vertical straight parts of the letter **G** are also varied in type forms and by different draftsmen. The form shown in the cut, however, is recommended as being most legible and in best taste.



The letter **Q** is made just as an **O,** with a distinguishing stroke added at the lower right hand part of the letter. This stroke is varied by different draftsmen to suit the fancy, but the form given in the cut is probably as neat and convenient as any.

Many beginners draw the letter **S** too narrow or too wide so that it is best to first draw the limiting verticals of the letter as shown. (It is well to do this also in the Roman **S**). Then the directions and order of the strokes given in the cut should be followed. The upper part of the **S** is smaller than the lower, as has been remarked in the first chapter of this book, and if the letter is properly made, the middle part of the letter will be almost, if not quite, horizontal.

Since the curved letters **C G O Q** and **S,** when placed beside the other letters of the alphabet, do not appear as tall as they really are, these curved letters should extend just a trifle beyond the guide lines, as in the case of the Roman forms of the same letters.

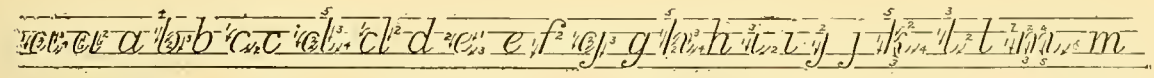
From the directions given in the above articles, and by consulting plates I and II, the student will be able to draw freehand, the ten figures in both Roman and Gothic styles.

Stump Letters.—In stump letters the direction and order of making the strokes is most important. In the accompanying cuts the writer's system is given. Before using this method the writer was only an indifferent master of stump letters, as can be seen in the words "Scale of Miles," and "Scale 3 Feet Per Inch" in plate IX. Since the method gives letters that "come down" clearly in reduction by photo engraving, it is recommended with some confidence. In making these letters it is necessary to use a fine pointed pen, since some of the lines are hairlines. For letters $\frac{1}{10}$ of an inch high or under, Gillott's Mapping, or Lithographic pen (or equivalent) is recommended. For

larger letters, Gillotts 170, will be found to be better unless the letters are extra large. Stump letters, however, are usually small, being employed for explanatory notes, or for the less important features of a drawing.

It will be noticed that nearly all the strokes are made in a downward direction. This is for several reasons; (1) with a little practice each letter can be better shaped by this method; (2) fine pointed pens being used the pen is not so apt to catch in the paper when the hairline strokes are made; (3) stump lettering can be done on rougher paper by this method, than by making part of the strokes upward. Of course, though, it is preferable to have hard, smooth paper on which to letter.

A is made in four strokes, strokes 1 and 3 being the main strokes, and 2 and 4 being hairline strokes made lightly and quickly in a downward direction, joining on to strokes 1 and 2 respectively. Some draftsman make the a in two strokes, as shown in the second a in the cut; they make strokes 1 and 2 of the first a at one stroke, stroke 2 of the first a being taken in an upward direction as a continuation of stroke 1. The objection to this is that the pen is liable to catch in the paper in taking an upward stroke, and thus blot the lower left hand part of the letter. This is especially so if a very small letter is made with an extra fine pointed pen.



The method of making the hairline strokes upward, if not objectionable as stated, would lessen the number of strokes in the various letters. Take the letter d for example; by the method given in the first of the three d's in the cut, five strokes are required. An expert draftsman might make the letter on smooth paper in two strokes, as shown in the second d. In this letter, strokes 5, 3 and 4 of the first d are made by one stroke, stroke 2.

However, as strokes 2 and 4 in both a and d are best made downward, so also the horizontal strokes, as 5 in d, are better made last, as quick hairline strokes, as then the student can place them more accurately.

The part of the letter a, made by strokes 1 and 2 in the first a, is similarly made in the letters d, e, g and q. The corresponding part of c is similarly made, excepting stroke 1 begins with a dot.

In the letter b the heavy stroke 1 is first made, then stroke 2 is made downward to join 1. If stroke 2 is made upward it is liable to carry ink from the heavy stroke and fill up or blot the acute angle between the two. This remark applies also to the similar strokes in the letters h, m, n, p and r.

The horizontal spurs at the top of the b, h, i, j, k, l, m, n, p, r, u, v, w, x and y are better made last, as separate light quick strokes. Some draftsmen make them as parts of strokes 1.

The letter e is made, as shown in the cut, although if the student prefers the heavy stroke may be made first the other two being made as hairline strokes in the direction indicated.

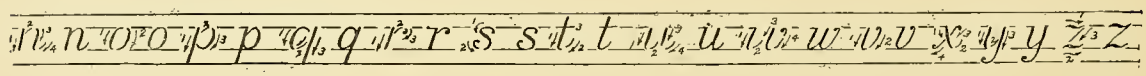
F is made in two strokes, and the form here given is more quickly made and in better taste than the form given in plate IV. The cross bar should be a hairline stroke on the upper guide line.

The first part of g is similar to the same part of a. Stroke 3 is a bold downward stroke tapering into a hair line on the lowest guide line and terminating in a dot. Stroke 1 in the letter j and stroke 3 in y are made in the same manner.

Stroke 1 in h is a bold, straight stroke, as are likewise strokes 1 in k and p, and stroke 3 in q. Stroke 3 in h begins with a slight curve at the end of stroke 2, comes boldly down at the usual slant, tapering into a slight curve on the lower guide in a direction opposite to the curve with which it began. Stroke 4 joined to the slightly curved lower portion of stroke 3 finishes the letter, with the exception of the spur (stroke 5), which is, as usual, made last as a quick, short hairline stroke. Similarly to stroke 3 in h, are made strokes 5 in m, and 3 in n.

The letter i is the latter part of the letter a with a horizontal spur added. The letter i will be seen to form a part of the letters v, w and y, while u may be regarded as two i's placed side by side, stroke 2 of the first i being made a little longer than usual, and the horizontal spur being left off the second i. The dots that complete the letters i and j are placed on the uppermost guide line.

In the letter k strokes 2, 3 and 4 are made as indicated. Do not crowd these strokes against stroke 1, as this is a common fault with many who are afraid of getting the letter too wide.



Stroke 1 in the letter l begins on the uppermost guide line, and is brought downward at the proper slant as a uniform bold stroke until it almost reaches the lower guide, where it terminates in a short curve to the right. Stroke 2, joining this lower curved extremity, finishes the body of the letter.

Similarly to stroke 1 in l are made strokes 1 in b, and 3 in d; also stroke 1 in t, although shorter, is made in the same manner.

Stroke 1 is made alike in the letters m, n and r. Stroke 3 in the m is unique, beginning with a slight curve at the end of stroke 2, and coming down with a bold straight stroke, parallel to, 1 to the lower guide line. Care must be taken to have strokes 1, 3 and 5 parallel and at the proper slant.

The letter o should always be made with two strokes as indicated, as the letter can then be properly shaped and properly shaded.

The letter p is not a d turned upside down, for there is no horizontal spur at the lower extremity of stroke 1.

Q is made like a letter g, with a difference in stroke 3. This stroke in q is a simple straight line without spurs or curves.

The first stroke in r is like that in m and n. Strokes 2 and 3 might be made in one stroke, as the upper part of stroke 1 in c is made. But since this is the

distinguishing part of the letter r it should be carefully made, and the method shown in the cut of making the strokes is recommended.

A good form for the letter s can be acquired by practice alone.

Stroke 1 in the letter t begins half way between the upper and uppermost guide lines, otherwise it is like stroke 1 in l. The cross bar in t is made as in f, by a quick hair-line stroke on the upper guide.

The forms of v, w, x and y shown in the cut above are easier to make than the forms given in plate IV. Since the latter plate was drawn the writer has had considerable lettering to do in the style we are discussing, and has found that the forms given or suggested in plate V in the word "always" are also simple and neat forms for the letters v, w and y.

After making stroke 1 in x, care must be taken in drawing stroke 3 across the first stroke, not to draw the ink of the heavy stroke into the lower angle. To avoid this it is sometimes better to make the lower part in a separate stroke, as in stroke 4 in the cut.

To make strokes 1 and 2 in z turn the pen sideways, and make the strokes quickly on the upper and lower guides. With a little practice this can be well done. A hair line, stroke 3, joining 1 and 2, completes the letter.

Always draw two guide lines for stump letters, and if you are a beginner, or are to execute an especially fine piece of work, draw two more, one on either side the first two, as shown in the cuts. Taking the distance between the first two guide lines at three units the uppermost guide line (as it has been called in the above discussion) will be drawn two units from the upper guide, and will limit the height of the letters b, d, f, h, k and l, and also the height of capital letters which are used with stump letters. The lowest guide is two units below the lower guide, and limits the lower extremities of g, j; p, q and y.

The letters which capitalize stump letters are usually inclined Roman capitals, although sometimes a modification of the Roman known as 'Law Italic' (see plate VII) is used, and looks very neat.

Single Stroke Roman.—The capitals accompanying stump letters, unless the latter are unusually large, are made rapidly by single strokes, as shown in plate V at the top of the plate. The directions for forming these letters can be seen from the alphabets there given. The first alphabet shows the order in which the strokes are made, the direction of making the strokes (unless otherwise indicated by an arrow), in all cases is downward for vertical or slanting strokes, and from left to right in the horizontal hair-line strokes. The second alphabet shows the letters as they should be completed, and this alphabet has also been drawn to a size corresponding to the alphabet of stump letters just below.

A few remarks on Single Stroke Roman may prove helpful. Single stroke Roman letters like stump letters are composed of heavy and of hair line strokes. Just as the height of the letters we are considering is five-thirds that of the stump letters that go with them, so, the thickness of the heavy parts of the single stroke Roman letters should be five-thirds of the thickness of the heavy

strokes of the corresponding stump letters. The draftsman, of course, usually gages the thickness by eye.

Although the alphabet first given in plate V is called "Single Stroke," yet not all the letters can be formed advantageously by single strokes. The downward projecting spurs of the T are better filled in (that is the angles filled in) after strokes 1, 2 and 3 are taken. So also are the similar parts of E, F, L and Z made. The middle portion of the letter S is made last, after strokes 1 and 5 are taken. It is generally difficult to make the middle or main portion of the S at one stroke, since the direction is so sinuous and the stroke also varies in thickness, so, the middle part of S will usually need retouching.

After completing the letter A by drawing the two horizontal spurs on the lower guide line, the letter may be improved by enlarging the junction of stroke 1 with the spur below; but the beginner must guard against making this enlargement too heavy otherwise, it had better be left alone. Similar portions of the letters K M N U V W X and Y may be treated in the same manner (see plate I for the correct forms).

Stroke 4 in the letter G is a short heavy stroke tapering to a point at the lower extremity, and at its upper extremity covering a portion of stroke 3. The acute angle between strokes 1 and 2 may be advantageously touched up a little (i. e. the angle filled) if too much ink is not used. Also the similar portions of the letters C and S may be treated likewise.

Strokes 1 in V, and 1 and 2 in W, should stop short of the lower guide line, the lower apex being made acute by the hair line stroke 2 in V, and by strokes 2 and 4 in W. The upper apex in the letter A may also be made acute in this way.

From the directions given above for the letters, the method of forming the single stroke Roman figures, given near the bottom of plate V, may be inferred. The remarks on the middle portion of the letter S apply to the figure 8. Strokes 2 and 3 in the figure 7 will also usually need retouching.

Single Stroke Gothic.—A form of single stroke Gothic letter is given in plate IV. The inclined Gothic letter is, however, more easily made, and directions for forming this alphabet are given in the two alphebets in plate V, the upper alphabet showing the order and directions of the strokes by the numbers and arrows, and the lower alphabet showing the appearance of the completed letters. Where arrows are omitted, inclined strokes, except stroke 2 in k, are made downward, and horizontal strokes are made from left to right.

For making these letters neatly and quickly a ball-pointed pen is essential. This style of pen can now be obtained from leading stationers, and is manufactured after an especial design, the nibs being indented just above their points, in such a manner that the pen glides smoothly in any direction, making at the same time a line of uniform thickness. These pens are made in different sizes, that is, to give lines of varying thickness; but for letters of small size a well worn common pen answers well. Gothic letters may be capitalized by the same style of letters of larger size, as shown in the lower part of plate V.

Single Stroke Roman

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

a b c d e f g h i j k l m n o p q r s t u v w x y z

SINGLE STROKE GOTHIC

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

RE-ISSUED—AUG 20—97—B

1542

PENNSYLVANIA LINES WEST OF PITTSBURGH.

SOUTH-WEST SYSTEM

TENDER, ALL CLASSES.

DRAFT RIGGING DETAILS.

A.R.H.

APPROVED COLUMBUS, O. 18

SUPT. M.P. CHIEF DRAFTSMAN

This is a Style of Lettering Used in The Engineering News

For Single Stroke Roman and Stump Letters and Figures a fine pointed pen should always be used

FOR SINGLE STROKE GOTHIC LETTERS AND FIGURES A BALL POINTED PEN SHOULD ALWAYS BE USED

1 2 3 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0

1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

The horizontal and inclined straight strokes in the letter G may be made with one stroke; also, it is not always necessary to have stroke 1 join stroke 2 exactly.

Stroke 2 in K begins on stroke 1 at two-fifths the height of the letter, and is made upward. Stroke 3 should be far enough away from 1 to keep the letter from appearing cramped.

With a little practice the letters M, N and W can be more rapidly made by taking the strokes in the order given in the plate. Otherwise the beginner should draw the outside strokes first.

If a fine pointed pen is used to make Gothic letters, care must be taken to bear on the pen with uniform pressure, also to keep the pen turned toward the draftsman on each stroke. Failure to do this gives results which are illustrated in the words, "Re-issued—Aug 20—97—B," in plate V, which were taken from a drawing, the title to which appears in the central part of the plate. Glancing at the letter E in the words mentioned, it will be seen that the horizontal strokes are not as thick as the slanting stroke, and were so made incorrectly, probably by making the strokes of the pen sideways and not toward the draftsman. Also, in some of the vertical or almost vertical strokes of the letter, it will be noticed that the lines are not uniform in thickness in all their parts. This is caused by uneven pressure on the pen.

Single stroke Gothic figures and method of construction are shown near the bottom of the plate. The middle portion of figure 2 should be almost horizontal, and should not strike down into the lower horizontal portion at an acute angle, as is common with inexperienced draftsmen. (See "Aug. 20" in the words mentioned above.)

In Mechanical Engineering the styles of letters used on drawings are usually of the simplest character. Roman, Gothic, and stump letters, or some modification of these, are commonly employed, the Gothic letters being, perhaps, used more than any others. The letters given in plate V are all suitable to use in mechanical drawings.

In the center of plate V is a title taken from a drawing made in the motive-power department of one of our leading railroads. It will be noticed that the letters are all of the plainest character, consisting of large and single stroke Gothic styles. Formerly in this department Round Writing was used, but the occasional ambiguity, caused by an extra flourish of a draftman's pen, proved serious enough objection to cause a change. Printed forms of a portion of the titles are kept on hand, and the draftsman traces this and adds the special name and number of the drawing. In the title given, the words "Tender, All Classes; Draft Rigging Details," together with the number 1542, and the draftman's initials, A. R. H., form the especial title, the other words and figures all being copied from the printed form. In this way all the titles are lettered uniformly, and all titles appear at the lower right hand corners of the drawings, for ready reference when the drawings are filed in drawers. The rectangle at the lower central portion of the title, is for the

stamp of the office, which indicates the date of issue of the blue print, none but blue prints being sent from the office. To the right of this is the date of the drawing and the chief draftsman's signature. To the left is the signature of approval by the superintendent of motive power. No scale is given in the title, since the measurements must be exact, they are therefore all marked on the details. Should any dimension be omitted by oversight, it is asked for by telegraph, the number of the drawing, 1542 in this case, easily and unmistakably designating the proper drawing. The number 1542 is the serial number of the sheet, all drawings being numbered consecutively in the order of their production.

For lettering the details of the above drawing, single stroke Gothic letters such as are shown in the words "Re-issued Aug. 20, '97 B" are issued. The size of the letters varies with the importance of the details; and the smaller Gothic letters are capitalized by larger letters of the same style. The first issue of a drawing is known as issue A. The design of the chief draftsman is tested on the road or in the shop. If changes are desired or recommended by the superintendent they are made in the chief draftman's office, the original number of the drawing being retained, and the number of the edition is indicated by a letter. In the case cited, the words "Re-issued Aug. 20, B," which were taken from the same drawing on which the title given above appeared, indicate that the original has been amended once and is now, Aug. 20, 1897, re-issued. The letter C would indicate that the drawing had been amended twice.

It has been said that Gothic small letters, such as are given in plate IV, or "Lower Case" Gothic letters, as the printer calls them, are difficult to make, and hence are little used in technical drawing. However, an example of a style of Gothic small letters is given just below the title in the middle of plate V, which style is easily made, looks neat, and is very appropriate for mechanical drawings. Explicit directions for forming this style, and upright letters of the same kind, are given in a book written by Mr. Chas. W. Reinhardt, chief draftsman of the Engineering News.

For title words in mechanical drawings, Gothic letters with shade lines drawn partly around them, are easily made, and look quite well. An example of this is given in the alphabet at the foot of plate V; in this alphabet the Gothic letters were quickly drawn by single strokes with a ball-pointed pen, and the shade lines added with a fine pointed pen. Block letters, also, are often seen in the titles of drawings appertaining to mechanical engineering.

Architectural Letters.—In architectural drawings usually lighter and more fanciful styles of letters are allowable than in the more technical classes of work. Architectural drawings are, to a greater extent than other drawings, made for public display or inspection, and on this account more *elaborate* or fanciful styles may be used; also, in such drawings there is usually an absence of black, heavy outline, and to harmonize with this a *lighter* form of letter than usual is suitable.

ROMAN OLD STYLE

ABCDEFGHIJKLMNOPQRSTUV

12345 WXYZ 67890

abcdefghijklmnopqrstuvwxyz

UNIVERSALIST CHURCH

DETAIL OF CABINET PARTITIONS IN PRIVATE OFFICE

End of Cornice SECOND FLOOR

DETAIL of CENTRAL

PORTION of MAIN FRONT

TOWNSHEND MEMORIAL

Scale $\frac{3}{4}$ in = 1 foot THE O.S.U.

799 June 1896 COLUMBUS O

Peters Burns & Helzinger

ARCH'TS

Dayton O

18

Clarence White

with

Geo. F. Barber & Co.

abcdefghijklmnopqrstu

1234567890

Robert C. Richards

with

Geo. F. Barber & Co.

Knoxville Tennessee

abcdefghijklmnopqrstuvwxyz

1234567890

ABCDEF

GHIJKLMNOPQRSTUVWXYZ

As in so many other classes of work, the Roman letter is made to do service in architectural drawing, in either its plain form with the outlines only, inked in, or in one of its many modifications. A modification of the Roman alphabet, known as a form of the "Roman Old Style," is shown at the top of plate VI; another modification is shown at the bottom of the same plate, and either one of these styles is appropriate for use in the titles of architectural drawings.

The second alphabet from the top, in plate VI, together with the letters and figures next above the last alphabet in the plate, are illustrations of more fanciful styles. These letters are better suited for title words than for detail work, as they will generally require too much time to be extensively used. However, they are more easily made than they appear to be at first sight. Permission to give these styles was kindly given by the draftsmen whose names appear in the plate.

In the central part of the plate is given a title (reduced one-third) to one of a series of drawings for a building now in course of erection. The words "Detail of Central" to the word "Dayton, O.," comprise the title, and it is given just as it appears upon the original, with the exception that the words "Scale ¾ in.=1 foot, 799, June, 1896," were placed below and to the left of the words "Dayton, O.," in the original, and the number "18" with the enclosing circles is placed approximately, but not exactly, as it is placed in the actual drawing. This number denotes the number of the sheet in the series of drawings made for the structure mentioned. The number "799" denotes the number of the contract or piece of work upon which the firm has entered.

For details in the same drawings above mentioned, a style shown in the words "End of cornice" is used. Also, for the more important details, or for sub-titles, the style shown in the words "Details of Cabinet Partitions in Private Office" is used. However, it will be seen that this latter is only a smaller size of the same style of letters which make up the words "Detail Central Portion," etc. Every draftsman in the office where the above drawing was made, is taught to use the same style of letter on the drawings issued by the firm. These letters may be very rapidly made, and they look very neat upon some kinds of architectural drawings.

The words "Universalist Church" are copied from the words as they appear upon a stone tablet in an existing structure. They will serve to show how letters may be modified when used for such purposes.

Some architectural draftsmen in using the Roman or modified Roman letters for title words, replace the letter U with a V. This mars the legibility of a word, and is for this reason objectionable.

Type Specimens.—In plate VII are given some type alphabets selected from the catalogues of the American Type Founders Co. and of Barnhart Brothers & Spindler. In the upper part of the plate are given standard type forms of letters and figures for engineering drawings. In the lower portion of the plate are given some less technical type forms. These latter styles might well be employed in architectural work.

Type forms really set the standard. To say that the lettering on a drawing "looks just like print" is usually the highest compliment it can be paid. People who read, are accustomed day after day to see type letters of either standard styles or of modified styles which are of recognized merit. If, therefore, on a drawing the lettering in general follows a type form, but departs irrregularly from it, the draftsman is pretty sure to be criticised. Also, since type forms have so much influence, it is possible, although it may not be desirable as viewed at present, that the standard styles set by type forms a few years hence, may not agree with those of to-day.

Type specimens, therefore, are worthy of careful observation and study.

(For mention of the title given in the central portion of plate VII, see article on Type Specimen in chapter on Title Lettering).

Remarks.—The plates and cuts illustrating the present chapter, were drawn freehand by the writer, in order to fairly treat the subject. The following extract taken from the preface of Prof. C. B. Wing's little pamphlet on freehand lettering is to the point: "The importance of freehand lettering seems to have been disregarded heretofore. The alphabets that have been previously given are adapted almost exclusively to the elaborate lettering of drawings that are to be engraved. In such cases time may be profitably spent on the drawing, because it becomes a small item when divided among a great number of prints. Working drawings, however, are blue printed only a few times, and the lettering must be done quickly or it costs too much. No one thing is more helpful to the young draftsman in gaining the confidence of superintendent and workmen than the ability to letter a drawing quickly, neatly, and so plainly that no workman can ever make a mistake because of inability to read words and figures."

"The author believes that every person can acquire a hand for lettering as well as for writing, and that nearly as much originality is shown in one as the other. It is recommended that beginners try copying several of the styles given; that they choose the one which seems easiest; and that they practice this with great persistence till they are able to reproduce it well and quickly. The acquiring of one hand gives facility in acquiring others."

"In some offices all draftsmen are expected to adopt the same style of lettering, in order to attain uniformity in the drawings. The author has in mind a set of standards for wooden trestle bridges in which the different plates were drawn by four or five different men; the lettering has a uniform appearance, but a careful examination will show the individuality of each hand."

"Nearly every one can learn to do good freehand lettering by careful, persistent work; but if any one should fail, he may select one of the geometric forms, using the right line pen and straight edge, and then strive to acquire speed in execution, without a sacrifice of legibility."

ABCDEFGHIJKLMNOPQRSTUVWXYZ&

abcdefghijklmnopqrstuvwxyz

Cape 1234567890 Town

ABCDEFGHIJKLMNOPQRSTUVWXYZ&

Lake 1234567890 Tsad

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z &

Steam 1234567890 Crane

a b c d e f g h i j k l m n o p q r s t u v w x y z

LAW IT ALIC

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z &

12345 abcdefghijklmnopqrstuvwxyz 67890

LOCK WITH 10 FEET LIFT

DETAILS OF

UPPER PORTION OF LOCK

OUTING

ABBCDEFGHIJKLMNOPQRSJTUUVWXYZ&

RESIDENCES 1234567890

QUAINT OPEN

ABCDEFGHIJKLMNOOPQRSTUVWXYZ&

PASSENGER 1234567890

ELANDKAY

ABBCDEFGGHIJKLMMNNOOPQRSTUVWXYZ&

ELEVATION 1234567890

DEVINNE ITALIC OUTLINE

ABCDEFGHIJKLMNOPQRSTUVWXYZ&

1234567890

Macadamize DEVINNE **1234567890**

ABCDEFGHIJKLMMNOPQRSTUVWXYZ&

TITLE LETTERING.

The title to a drawing should answer distinctly the four questions, what, where, when and who. In other words the title should tell what the drawing represents, for what use it was made, and to what scale it is drawn; where the tract or object represented is located, and where the drawing was made; when, giving the date of the survey or design, and the date of drafting; who the designer or chief engineer is, and who did the drafting. Thus in plate VIII, where several examples of titles are offered for discussion, the first title given answers these questions.

The different parts of a title should be made prominent in the order of their relative importance. Thus, taking the above mentioned title as an example, the words "Chattanooga to Stevenson, Ala.," are made the most prominent, because we are supposing the entire line to be profiled in two or more sections, each section being profiled on a separate sheet or roll of paper, and one section embracing that part of the line lying between Chattanooga and Stevenson; it is desirable to know at first glance which part of the line the profile in hand represents, and the words Chattanooga to Stevenson tell this. If the profile represented the whole line complete on one piece of paper, then the words "East Tenn. and Ala. R. R." should have been most prominent. The other words are lettered to catch the eye in the order of their importance. The second title, given in plate VIII, is taken from the records in the office of the Ohio State Canal Commission. Here the several canals of the State have been mapped by sections, each section being drawn on a separate sheet. The sheets are bound in book form, one set of books to each canal, and the title mentioned above has been taken from the set showing the Miami and Erie canal. The portion of this canal lying in Cincinnati, having been drawn in several sections, the words, in the title selected, in the order of their importance are "Eggleston Avenue," "Cincinnati, Ohio," and "Miami and Erie Canal." Of course the draftsman should know beforehand the order of the importance of the words before he begins to draw the title, and sometimes when a number of different drawings are made in series, it will require considerable thought to arrange the styles and sizing so as to obey the rules already given and at the same time have all the titles appear uniform, and have each title harmonize with the drawing on which it appears.

Where drawings are made to illustrate written descriptions, or are accompanied by written descriptions, the title is, of course, often not so comprehensive. When the drawing represents some familiar object, a simpler title is also often used. Thus the last title shown in plate VIII is an example. Such a title might be used on a drawing, made for public display, of a well known tract of land. However, it is a good rule to make drawings as nearly as pos-

sible self-explanatory, and there is little or no danger of getting too much information on them in a neat and concise form, even though they may be accompanied by full written descriptions. The descriptive part of a title is sometimes placed in small print on another part of the drawing, apart from the main portion of the title.

Position of the Title.—The title should be so placed on a drawing as not to appear cramped. It is sometimes placed outside the border, especially when it consists of a single line of letters, but this rule should not be followed when a suitable place can be found inside. A general rule, is to place the title above or below the centre of the drawing, near, but not too near, the border, and if the drawing is symmetrical, the title should have the same axis of symmetry. If the drawing is unsymmetrical, the title may be placed in either of the corners. In drawings of irregular objects, maps of irregular tracts and the like, the title may be put wherever the shape of the drawing the affords best space, considerable freedom being thus allowed.

On drawings which are too long to be seen at one glance, as profiles or roll maps, two or more titles, if necessary, may be used at convenient distances apart. Where a series of drawings are to be made for permanent records, and are to be filed away in drawers or cases for reference, it is often desirable to have the titles on the separate sheets appear in the same corner in each one, for convenience in handling. When this is the case the selected corner should be reserved for the title beforehand on each drawing. The lower right-hand corner is the one usually chosen in such a case, but any one of the others may be selected if desired. The matter is determined often by the shapes of the plats.

Size of the Title.—In the first place the size of the title, as a whole, should be in proportion with the drawing. For drawings of small scale the title should usually be smaller than the title of a drawing of larger scale on the same sized sheet. The following specific rule may be found helpful: When a drawing held in position has its longest border horizontal the length of the title should not be greater than one-fifth the length of this border, and the height (width) of the title should not be greater than one-fourth the length of the shorter border. Even this rule often allows too large a title.

The largest letters of the title, which will generally be used for the name of the locality mapped, the structure planned, or the like, should not be greater in height than $\frac{3}{100}$ of the length of the shorter border; the smallest letters of the title will usually be used for the date, the draftsman's name, and for explanatory notes, and between these two sizes the other words of the title will require letters of intermediate sizes, according to their relative importance. For a scale of $\frac{1}{10,000}$ (1 inch = 833⅓ feet) Reed gives the following practical rules for maps: "Make the largest letters of the title, for a map of about two feet by three feet dimensions, three-tenths ($\frac{3}{10}$) of an inch in height. For a map of about one foot by one and a half feet dimensions, make the largest letters of the title two-tenths ($\frac{2}{10}$) of an inch in height, and propor-

tionally for maps of other dimensions; and since explanatory notes are always very small letters, the intermediate grades are readily assigned."

Form of the Title—The form of the title may vary considerably according to the size and shape of the space in which it is placed. Thus when the space allotted is high and narrow, the title should be designed as nearly in harmony as possible. Where the title must occupy a long space, which is not very high in proportion, the letters of the title may be correspondingly flat, and to gain this end the letters may be extended as in the word "Extended" in plate III. The title must be distinct and not appear to be cramped, nor must the line of letters be so far apart as to give the title a loose or disconnected appearance.

Sometimes the title consists of a line (row) or more of letters across the entire top of the drawing, but generally it will consist of straight lines of letters grouped as in the second title given in plate VIII, or of some simple combination of straight and curved lines of letters as the first title given in the same plate. Where the lines or rows of letters are curved, usually arcs of circles are used with the center of the arc on the axis of symmetry. Other forms may be devised, but some such simple combination as either of the ones illustrated are generally employed. One form of title that is seen occasionally is in bad taste; it is the form in which the curved lines sag towards (are convex towards) the central line of letters. When the letters are arranged in this manner the curved parts give the impression that they have no connection with the rest of the title. The curved lines should be arranged concave towards the central line, as the word "Profile" is towards the line of letters "Chattanooga to Stevenson, Ala.," in the first title given in plate VIII.

Where the space allotted to the title is irregular in shape there is often room for much ingenuity in arranging the title to harmonize with its surroundings. Where titles are required for elaborate drawings, which are made for display or similar purposes, title lettering becomes an art by itself. An example of a more elaborate title is given at the bottom of plate VIII, but it is rarely necessary for the engineer to make such titles.

Construction of the Title.—The construction of a title is illustrated in the second one given in plate VIII, to which reference through the following discussion should be made. Having determined the position, size, and form of the title, which words should be given most prominence, etc., rule pencil lines for guides as shown, parallel to the bottom of the drawing. Then write on scratch paper and number the letters of the main words, thus:

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 6
E G G L E S T O N A V E N U E,

counting also the space, or spaces between words. We see that the whole number being sixteen the center line should be between the eighth and ninth letters, *provided* all the letters and the space between words are of the same width; but we already know that letters are not all of the same width, and suppose, in the present case, that we wish the interval between the words to

be a little narrower than the space occupied by an average letter, which is the usual distance allowed between words. Noticing this point, and that the letters A and V are the widest letters of the row and occur on the same side of the center, but are spaced slightly closer together, as explained previously, we would say as a first approximation that the center line comes nearer the O than the N in the word "Eggleston." Accordingly we begin near the center and pencil in the letter N, then space off the interval between the two words, and pencil in the word "Avenue." With the compass measure off to the left of the center a distance equal to that from the center line to the end of the word "Avenue," and at the point thus found begin to pencil in the word "Eggleston." Now, if the position of the center line relative to the row of letters has been correctly estimated, the letters will fall in their proper places ; if not, the work must be erased and another trial made ; by erasing a few of the letters near the center slight discrepancies may be adjusted. The advantage of lettering one-half the row at a time in this way, is, that if the first approximation is not right, usually only a few words near the center need be erased to gain the proper adjustment, whereas if we begin at the left-hand end first and letter through the row, the whole row might have to be erased.

Suppose that the next line of letters in the same title we wish to be shorter and smaller, and we mark the limits as shown by the short vertical lines at equal distances from the center. In this case suppose we do not wish to take the time to mark the letters on scratch paper and number them, now that we have one line of letters penciled in already as a further guide. If we begin at the left-hand and letter through to the right, the last letter may fall outside, or partly outside, the limiting line as shown, and we would have to erase and try over again. It would be better to pencil the word "Ohio" backwards from the right-hand limit and then commence at the left-hand and pencil in the first word, allowing any small discrepancy to fall in the space allowed as an interval between the two words, for the space allowed for an interval between words does not have to be so exact as that allotted to a letter. This method of lettering from extremities towards the center, illustrates a second way of penciling in the rows of letters.

Thus we see that the process of sketching in the lines of letters of a title is a series of approximations ; but the practiced draftsman does not stop to measure precisely the differences in width between the different letters and intervals to calculate exactly where the center line would fall, but from a casual consideration of these points and from previous experience, he estimates where the center would fall, and is usually able with few or no changes to correctly pencil in the line at the first trial. It is a mistake beginners sometimes make to think that the middle letter of the row should fall on the center. The letter P, in the first line of letters in the title we have just discussed, happens to fall at the center, because the letters M and A on the left of the center are wider than the other letters in the line, and the interval between words on the right of the center has, for compactness in this case, been made

PROFILE
OF THE
EAST TENN. AND ALA. R.R.
CHATTANOOGA TO STEVENSON ALA
LOCATION SURVEY MADE 1887
J.C. BREWER CHIEF ENGINEER
PREPARED FOR THE DIRECTORS OF THE
EAST TENNESSEE VIRGINIA & GEORGIA RY.
VERT. SCALE 1 IN=20 FT. HOR. SCALE 1 IN=400 FT.
CH'F ENG'RS OFFICE CHATTANOOGA — • — DRAWN BY C.E. SHERMAN SEP 1889

MAP OF
E G L ST IN AVENUE
CINCINNATI OHIO
SHOWING LOCATION OF
M AND RIE CANAL

MAP OF
EGGLESTON AVENUE
CINCINNATI, OHIO
SHOWING LOCATION OF
MIAMI AND ERIE CANAL

PROPERTY
OF THE
CHEROKEE
LAND IMPROVEMENT
COMPANY

smaller than usual. The beginner should also be cautioned about getting the lines of letters too far apart. The distance between two rows of letters in a title should seldom be greater than the height of the largest letters on either side of the space we are considering. The whole title should, of course, be drawn in pencil before being inked in, the pencil lines being afterwards erased.

The Style, or Styles of Letters, to be used in the title should be appropriate to the drawing as a whole; they admit of more variation, however, than the lettering on any other part of the drawing. The letters of a title may all be of the same style, differing only in size, they may all be of the same style and shaded differently, or they may be of different finish and size in the same title.

'The letters should correspond in conspicuousness, or body of color, with the rest of the drawing, not being obtrusive from great heaviness of solid black outline, or unobservable from excessive faintness. Also violent contrasts of heaviness among neighboring portions of the title should be avoided; although there may be a gradual change both of intensity and size from the most to the least important words of the title. Plain and simple titles look best on similar drawings, while a complicated and highly finished drawing may receive a title of a more ornamental character.'

The matter of punctuating the title varies considerably in practice. Usually the words are so arranged that no punctuation marks are required, except for abbreviations, and the periods after well known abbreviations may even often be omitted. It is best, however, to print all the words in full unless there is not room enough, or the title would appear entirely too cramped in the space in which it is to be placed. The title should not be conspicuous for its punctuation marks, nor conspicuous for their absence where they are needed. The punctuation and abbreviation should be governed by the following rule: The title should be so executed that no mistake can possibly be made as to its meaning.

To add to the effect of a title, or relieve it from undue stiffness, flourishes are sometimes employed. This is illustrated in the title given at the bottom of plate VIII. In the first title given on the same plate, in the last line between the words "Chattanooga" and "Drawn," is a flourish. Some such flourish as this, two examples of which are given in plate IX, may be placed between rows of letters which are too far apart horizontally or vertically, to relieve the undue stiffness. Two other simple designs for flourishing are given in plate IX at the right and left of the central star, one of which, or some similar design, might have been used in the above mentioned title, had the words "Profile of the" been arranged on the same curved line, leaving too much white space between it and the next line below, the flourish being used to partially fill this space. But where flourishes are used they should be simple in design, for it is easy to overdo the decoration.

Titles placed on banners or fluttering ribbons, or amidst landscape sketches on technical drawings, are a waste of time, and, besides, are nearly always in

bad taste. As in the rest of the drawing, no handwriting should be allowed in the title.

When to Ink the Title.—The title of a drawing should be inked in last; for after all the other details of the drawing are finished the draftsman may 'balance' partially the whole drawing, by taking advantage of the freedom, allowed in selecting the styles and finish of the letters used in the title.

Sometimes the title is drawn on a separate piece of paper and then copied on the drawing. The advantage of doing this is, that before copying, alterations may be made until the title is seen to harmonize with the rest of the drawing. This scheme is especially useful in cases where elaborate titles are to be made, and it is desirable to do as little erasing as possible on the drawing.

Type Specimen.—In the central part of plate VII is given a portion of a title (reduced one-half) taken from one of a series of drawings (blue prints) of concrete structures, designed for the Illinois and Mississippi canal, which is being built under government supervision. The remainder of the title consists of the words "Scale $\frac{3}{8}$ in. = 1 ft.," together with a scale diagram, which for lack of space has been omitted in the plate. It happens that the number "10" comes at the middle of the first line, and is made larger to give a pleasing effect. But attention is called especially to this feature; the letters of any one line are all (with the exception noted above) of the same size, irrespective of the importance of the words. Thus in the last line of the title, the letters in the word "of" are made the same size as those in the words "upper portion" and "lock." This plan has been carried out throughout the titles and subtitles of this series of drawings, with manifest advantage. The lettering, including the figures, (which is the finest the writer has seen) was first done with sets of type and a hand stamp, as described on page 4, on drawing paper, then the drawing and lettering together were traced on vellum from which the blue prints were made.

CONCLUDING REMARKS ON LETTERING.—We have given in the preceding pages both mechanical methods, by means of which any person can learn to form letters and words, and illustrations and practical suggestions by means of which the student may improve himself in freehand lettering. Beginning with the study of the forms of the individual letters, the student, by studying spacing, sizing, disposition, and styles, progresses through mechanical methods, freehand lettering and title lettering, until he has mastered the whole subject of technical lettering. In the preceding pages it has been attempted to explain the principles and governing laws of the subject in so far as they are discoverable, so that any student by study and practice may master the subject. It should be born in mind, however, that the lettering, as well as the other features of a drawing, are intended primarily to suit the eye, that is, to convey the ideas, the drawing is intended to convey, to the mind through the medium of the eye, and to gain this end we find we may often depart from rule. For this reason it may happen that a person may observe every recognized law of the subject, and yet not excel in drafting,

while a person who has never studied the subject may be a good draftsman, although it is likely the latter unconsciously follows the governing laws.

However, the writer believes that the skill for lettering technical drawings well, is an accomplishment which can be acquired by study, by observation, and by practice; that beyond this we enter the realm of art where talent is required, but that as technical drawing makes up a large part of the work of the engineer, he should strive to perfect himself in this branch. Lettering, therefore, as a prominent feature of technical drawing, should receive its due share of attention. In closing, let us again urge the importance of practice. No one would think of learning to swim by simply *reading* how to do it, so, no one can learn to letter by simply perusing text. In no other business is the saying truer that it is work that makes the workman.

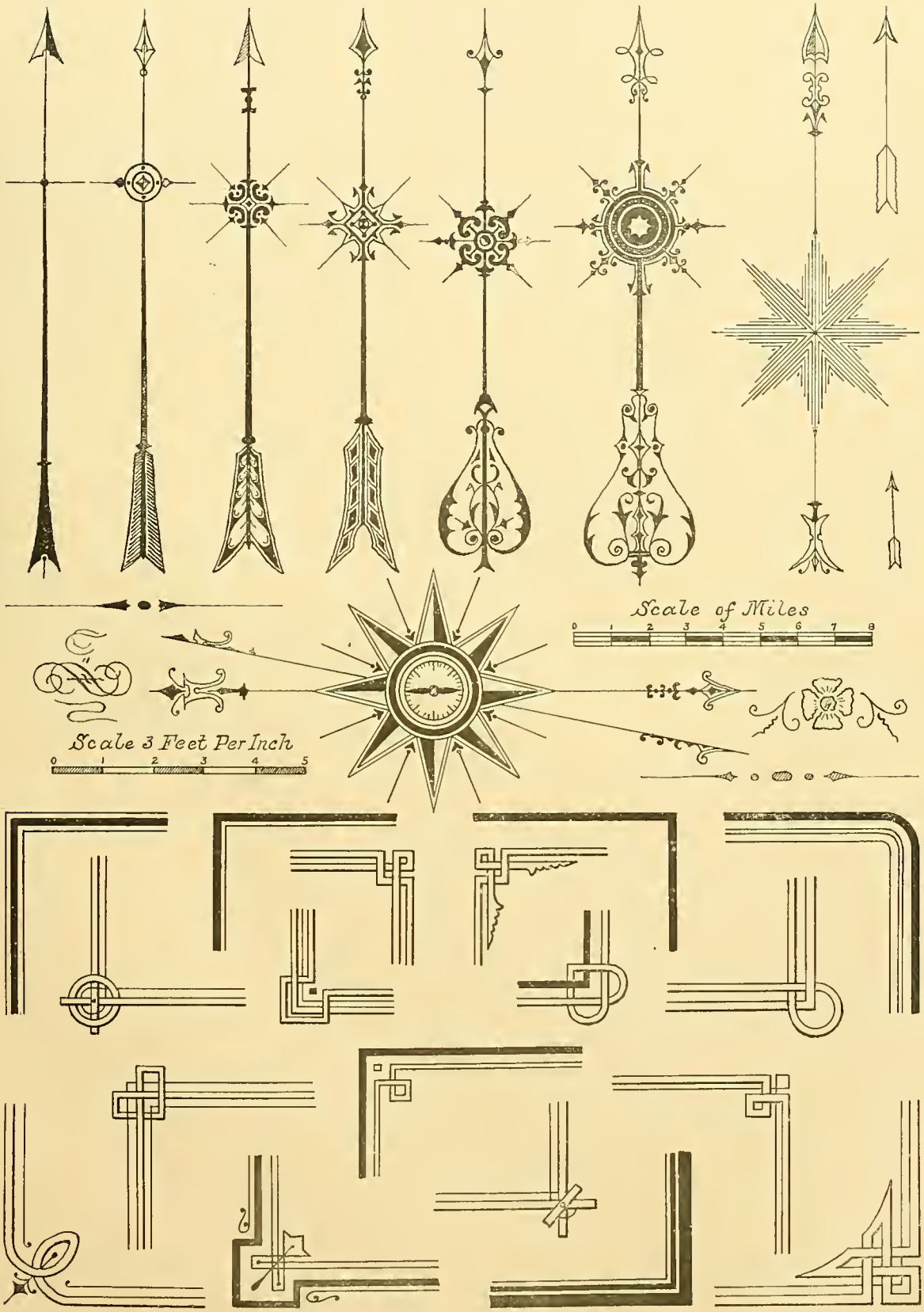
NORTH POINTS, SCALES AND BORDERS.

The subject of north points, scales, and borders, although not a part of lettering, will be treated here in connection with that subject, as it is usually so treated in such books as have touched upon the matter. In what follows use has been made largely of a chapter on map drawing and lettering by C. S. Dennison in Hodgman and Bellows' "Manual of Land Surveying."

North Points.—When the drawing is a map or plat of a survey, north points or meridians are used to indicate direction. If no north point appeared on such a drawing, the top would be taken to represent north, the right hand east, and so on. Regarding north points, the following is taken from the article by C. S. Dennison :

"A true meridian is a necessary adjunct of all rightly constructed maps, as it is directionally their common line of comparison, and without it no just notion of the situation of the territory represented by the map, or of the bearing of its lines, can be obtained. It is, in fact, one of the co-ordinates to which reference is made for the solution of all problems of position on the drawing, and as such is entitled to consideration. This line should, therefore, be a somewhat conspicuous object, and the object of its existence demands that it should not be so obscured by ornament as to defeat its use as a sharp, clear line of reference for all north and south lines. Nevertheless, the draughtsman is warranted in giving to its construction more than a hasty or careless consideration. It is usual to ornament the northern end of this meridian with some neatly drawn and characteristic device, such as an arrow head, a fleur-de-lis, the head of a mediaeval lance, etc. At its southern extremity is sometimes placed the feather end of an arrow or a crescent. Near the middle of the line may be drawn an east and west line, or four or eight pointed star, or radiating lines marking convenient points of graduation of the circle. It is well, also, to draw the magnetic meridian at the time of the survey, through the middle point of the true meridian, and mark the declination. This magnetic meridian should be even less ornamental than the true one, and when both are used it is generally agreed to draw a complete arrow head on the latter, while the magnetic line is subordinated by giving it only half a head, drawn on the right or left hand side, as the declination is east or west."

"The construction of a meridian affords considerable opportunity for the display of skill and taste in the draughtsman. It may easily be made an attractive, simple and elegant figure, reflecting the intelligence and spirit of an accomplished workman; or by its awkward design and slovenly execution, shake one's confidence in the mental capacity of one upon whom we should


Scale of Miles
0 1 2 3 4 5 6 7 8
Scale 3 Feet Per Inch
0 1 2 3 4 5

have a right to rely. Perhaps it would not be inappropriate to say that the meridian line should be sufficiently long on most maps, to serve conveniently the purpose of transferring its direction to other parts of the drawing by means of a triangle and straight-edge. The arrow head at the vertex should be a sharply pointed figure, entirely different from the obtuse, non-descript, object which too often offends the eye in that position. And, to avoid all possibility of mistake, it is well to place the letter N some slight distance above or below the arrow point. When a star is used to give the various points of the compass, its radiating arms should be narrow and slender, with sharp points, avoiding all appearance or suggestions of dullness. In short, the entire figure should be constructed in the spirit of lightness and radiation, in harmony with its office, which is simply that of indicating *direction.*"

In plate IX are given eight designs for north points which were taken from Esser's 'Alphabets.' For ordinary use one of the first four will generally be found appropriate. However, if the drawing is more elaborate, one of the more elaborate ones may be selected to correspond, or the draftsman may design one to suit the case in hand. As already stated, a star is sometimes used. When the magnetic meridian is also indicated, as in the north point lying horizontally in the center of the plate, the amount of variation from the true meridian should be stated in print between the two. The size and position of the north point may vary considerably. Usually it is placed somewhere near the top of the drawing where the shape of the latter affords a convenient place, but sometimes when it consists of a simple design it is drawn directly upon the other features. This plan, however, should not be followed when a convenient place can be found for it. Its size will depend upon the size and scale of the drawing. Generally it will be slightly shorter than the length of the title.

Scales.—The scale of the drawing should, of course, invariably be given. This is done either by indicating it in print, or by drawing for the purpose some such design as is seen in plate IX at the right of the upper part of the central star, or by a combination of both, as for example, the design to the left of the lower part of the same star. Where the drawing is not to be reproduced, as a plan, or other drawing made for office use only, the scale may be indicated simply by lettering, as in the first title on plate VIII ; but where the drawing is to be reproduced by any one of the various processes of printing, as for example, a map to be engraved, it is better to indicate the scale by some such design as either of those shown in plate IX, as the reproduction may not be of the same size, and, therefore, not of the same scale as the original, and the design will serve to show the amount of reduction or enlargement. The scale is generally placed near the title, usually underneath the title ; if this rule is not followed, the scale is placed in some part of the drawing where it can readily be found.

Borders.—Strictly speaking, the border is an unnecessary part of the drawing, as the utility of the latter would not be injured by the entire absence

of a border. But, in at once limiting the eye to that portion of the paper which has a distinct claim upon its notice, and in adding materially to the impression of completeness, accuracy, and neatness which one receives from such a drawing, the border is not without even some utilitarian value. As has been said of the north point, the title, and the lettering in general, the border should agree in character with the rest of the drawing. In the lower part of plate IX a number of designs for borders are given. The simple heavy line, or a heavy line enclosing a lighter one, is a very good border for ordinary drawings. Two light lines enclosing a heavy one in the manner shown, is a border that has been much used by the United States engineers. Very elaborate drawings, or drawings made for display, may receive more ornamental borders ; but even in such elaborate drawings it should be remembered that freehand decorations representing garlands, vines, tassels, etc., are generally in bad taste. The simple borders used on the fine maps of the United States Coast Survey show that plain borders are often not inconsistent with elaborate drawings, and that the beginner is therefore in more danger of overdoing than underdoing the matter of borders.

The border on a technical drawing usually encloses a rectangular area, and should be made to enclose as small an area as is possible without appearing to cramp the drawing. To gain this end it is sometimes convenient to break the border and allow projecting parts of an irregular figure to protrude beyond. When parts so protrude, they should not protrude farther than half way between the border and the edge of the paper, if it is desired to attain neatness in the drawing.

Regarding the width of the border, "a rule commonly followed is to make the total width of the border about the one-hundredth part of the shortest edge of the drawing, supposing the latter to be rectangular in shape. If two lines, a heavy and a light one, are used for a border the white space between the heavy and light line is usually made about the width of the heavy line." The distance between the border and the edge of the paper is also a matter for consideration. The usual width of this margin around the border is an inch and a quarter, or an inch and a half, on drawings of less dimensions than, say, two and a half feet by three feet. The width of this margin, however, depends upon circumstances, such as the scale and shape of the plot ; for example, of two drawings made on the same sized sheets, the one drawn to the larger scale may consistently have a wider margin. It is best to allow at least an inch and a quarter on all drawings, we may safely say. Of course, if collections of drawings are to be bound the above rules may be modified to suit the circumstances.

REFERENCES.—In writing the present treatise the following works have been consulted :

Appleton's Cyclopedia of Technical Drawing, pages 65 to 70, and pages 174 to 181. There are some good suggestions on spacing in this book which have been quoted in the article on the spacing of letters in the present treatise at page 4.

A Practical Treatise on Topographical Drawing, extracted and slightly modified from Appleton's Cyclopedia and edited by Wm. E. Worthen. This work is comprised in Appleton's, but has a few suggestions in addition.

Ames' Alphabets is a collection of 35 plates of letters and figures "adapted to the use of architects, engravers, engineers, artists, sign painters, draftsmen, etc." This work contains several plates of letters suited to engineers, but the majority of the plates are too ornamental for technical drawings.

Plain and Ornamental Standard Alphabets, by Frederick Copley, is a collection of 46 plates of "alphabets of all the various hands in modern use, with examples in each style designed, as a text book." This is the best collection of alphabets extant for the use of engineers and comprises all those practical styles previously published. The most of these alphabets are too elaborate for technical use, but there is one excellent plate of "Analytical Roman" letters which has been used, with several slight modifications, in making plate I.

Freehand Lettering for Working Drawings, by Prof. C. B. Wing, of Leland Stanford, Jr., University, is a little pamphlet of alphabets, only three or four of which, in the writer's opinion, are to be recommended for ordinary use. There is a pithy preface to this pamphlet, which has been quoted from on page 28, this book.

Industrial Science Drawing, Part II, by S. Edward Warren, contains in article 246, page 146, a few suggestions on lettering, including title lettering.

Draughtsman's Alphabets, "a series of plain and ornamental alphabets," by Herman Esser, is a collection of 31 plates of letters for draftsmen, sign painters, architects, etc. From this work have been taken the eight designs for north points, given in plate IX. For the rest of this book, the remarks made about Ames' alphabets will apply.

Students Alphabets is a pamphlet of eight plates taken from Esser's book of alphabets and slightly modified, published by Keuffel & Esser, New York and Chicago.

Topographical Drawing and Sketching, by Lieut. H. A. Reed, from pages 63 to 69, contains some valuable ideas on lettering topographical maps. These suggestions are applicable to general maps and have been quoted in part in the article on Disposition of the Letters, page 7 of the present treatise.

The Draughtsman's Handbook of Plan and Map Drawing, by G. G. Andre, contains some useful matter on lettering, together with three or four plates of letters. The book is an English one and is not near up to the needs of the times.

A Manual of Topographical Drawing, by Lieut. R. S. Smith, contains some suggestions on lettering in articles 78 and 79, and 80 and 81, pages 40 to 45.

In a Manual of Land Surveying, by Hodgman & Bellows, is a chapter on map drawing and lettering, by C. S. Dennison, which is well worth reading by every draftsman. This chapter, as already mentioned, has been drawn upon largely in the article upon north points, scales and borders.

In the Manual of Topography, by J. Enthoffer, the æsthetics and construction of letters is elaborately discussed on pages 23 to 33, and three plates of letters are given to illustrate the text.

The Book of Ornamental Alphabets, Modern and Mediaeval, by F. Delamotte, is a collection of 54 plates of alphabets, initial letters, etc., all of which are too elaborate for use on technical drawings.

A System of Easy Lettering, by J. H. Cromwell, is a paper-bound collection of twenty-six plates of alphabets. In this work is shown a method of lettering in which "we have but to divide any surface we may wish to letter into squares (or parallelograms, as the case may be), in pencil lines; form the required letters, in ink or paint, according to the style chosen; erase the pencil lines, and the lettering is complete." This method, however, results in letters too stiff and awkard in appearance to be used very much

In the Theory and Practice of Surveying, by Prof. J. B. Johnson, the short article on map lettering, article 420 on page 575, is pithy and to the point.

Mechanical Drawing, by C. W. MacCord, is 'progressive exercises' for mechanical engineers, in its first part, but contains on page 52 a plate of good borders for drawings of machines, etc. Some of these borders have been selected or modified for plate IX, of the present work.

The attempt has been made to include in the present treatise, all there is on lettering in the above mentioned books that is of practical value to the engineer.

Since the first edition of the present treatise, the following books on lettering have come to the writer's notice :

Plain Alphabets for Office and School, a paper bound book of 16 plates of letters and figures, of various styles, without text, by C. G. Wrentmore.

Lettering of Working Drawings, by J. C. L. Fish, comprises 13 plates of letters and 9 pages of text. The alphabets given were collected from various engineering offices, as examples of styles used in working drawings.

Freehand Lettering, by Frank T. Daniels, is a neat little book 6 x 7½ inches, with 13 plates and 32 pages of text on freehand lettering.

Lettering for Draftsmen, Engineers and Students, by Chas. W. Reinhardt, explains clearly with plates, text and cuts, the method of forming the various letters used in the Engineering News engravings.

Plain Lettering, by H. S. Jacoby, is a very carefully prepared work of 48 plates and 82 pages of text on lettering. Considerable effort is spent by the author in developing a definite system of spacing. If the system is to be judged by its results as shown in plates XIV and XV of the book, it is of doubtful advantage. The work, as a whole, is the most complete that the writer has seen, and the student who wishes to pursue the subject of lettering farther, is referred to its pages.

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